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implementation by the Hellenic Navy

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THESIS

ASSESSMENT OF THE IMPLEMENTATION
OF TOTAL QUALITY LEADERSHIP (TQL)
ON U.S. NAVY OPERATING FORCES AND
PERSPECTIVES FOR FUTURE IMPLEMENTATION
BY THE HELLENIC NAVY

by

LCDR Alexandros Theodossiou

December, 1993

Thesis Advisors:

Roger D. Evered
Linda E. Wargo

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(TQL)
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IMPLEMENTATION
BY THE HELLENIC NAVY

by

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Submitted in partial fulfillment
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ABSTRACT

In a continuous effort to improve the effectiveness and operational readiness of its forces, the Hellenic Navy is seeking for improved quality to meet its future needs. Such a quality improvement could possibly be realized from a Total Quality Leadership (TQL) process that is currently being implemented in the U.S. Navy. This thesis uses the framework of Dr. E.W. Deming's philosophy of management and his fourteen points to assess the ongoing implementation of TQL in the U.S. Navy Operating Forces. Using personal interviews and a survey climate questionnaire, selected TQL-educated officers in various parts of the U.S. Navy (Aviation and Helicopter Squadrons, and ships), gave their experiences of TQL. The survey was also given to the Greek Naval Officers studying at the Naval Postgraduate School. The resulting information provided the means to evaluate the performance of TQL in the USN and to determine its possible applicability in the Hellenic Navy.

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I. INTRODUCTION

This chapter begins with an introduction to Dr. W. E. Deming and his philosophy. It then discusses the emphasis on quality in the public and private sector in the USA, defining the origins of Total Quality Management/Total Quality Leadership (TQM)/(TQL) and introducing the rise "total quality" principles in the Department of the Navy.

TQL perspectives for the Hellenic Navy are also examined. Subsequently, the thesis objective, research questions, limits and assumptions are presented. Finally, this chapter concludes with an outline of the organization of this study.

A. BACKGROUND

1. Deming and Japan

After World War II, the Japanese had their industrial base completely destroyed. Their only remaining main resources were their determination and industrious work force. The Japanese had to find a way to start from scratch and to apply these resources, in order to rebuild their industry and their Nation. Dr. W.E. Deming is one man who taught the Japanese the way to rebuild their economy.

Dr. W. Edwards Deming is considered a legend in Japan because of his significant contribution to turning the Japanese economy around after World War II. As part of the

Japanese reconstruction, General MacArthur took 200 scientists and specialists, including Dr. Deming, to Japan to help rebuild the war-ravaged nation. Dr. Deming gave a lecture to Japanese CEOs about using statistics in manufacturing to achieve quality at reduced cost. Dr. Deming emphasis on quality through his teachings on good management practices, a well-educated and trained work force, and an understanding and use of statistical techniques was adopted by Japanese companies and resulted in the very impressive comeback of the Japanese economy [Ref. 1:p. 1-3].

2. The emphasis of quality in the U.S.A

On the other hand, even though statistical quality control had been practiced in the USA during the war¹, afterwards these methods were dropped due to the high demand for consumer products. The USA was the only highly industrialized country that still had its factories intact.

Due to great worldwide demand for American consumer products, quality had given way to quantity and quotas, and short-term profits. By the end of the 1970's however, demand for high quality Japanese products forced private industries in the USA to rethink their traditional management policies. They changed to Total Quality Management.

TQM can be defined as follows:

¹Dr. Deming taught 23 Statistical Quality Control (SQC) seminars around the U.S. in the 1940s. [Walton , The Deming Management method, Perigee books,1986]

- **Total**, implies applying the search for quality to every aspect of work, from identifying customer needs to aggressively evaluating whether the customer is satisfied.
- **Quality**, means meeting and exceeding customer expectations.
- **Management**, means developing and maintaining the organizational capacity to constantly improve quality.

Under TQM, continuous quality improvement requires a new way of managing work, in which employees are not simply ordered around but are asked to think and to participate in the process of organizing work [Ref. 6:p. 6].

In 1980 the USA re-discovered Dr. W.E. Deming. Since then, his philosophy has spread throughout the private sector in such companies as the Ford Motor Company, IBM, AT&T, General Motors.

3. The DON gets involved

On 13 August 1990, Admiral Kelso, Chief of Naval Operations, issued a memorandum to all flag officers indicating his intentions to implement Total Quality Leadership (TQL) throughout the Department of the Navy.

Total Quality Leadership (TQL) was to be the Department of the Navy's (DON) version of Total Quality Management (TQM).

TQL is the DON's alternative to traditional quality control philosophy. It is defined as the application of quantitative methods and people to assess and improve:

- materials and services supplied to the organization
- all significant processes within the organization,
- meeting the needs of the end user, now and in the future.

TQL was developed by the Department of the Navy for the Department of the Navy. DON leaders examined various approaches and concluded from their studies that Deming philosophy and methods best suited the unique requirements of the organization. In the view of the Department, his approach is the most comprehensive--driven from the top, focused on the user, with decisions based on hard data [Ref. 10:p. 22].

Deming's approach:

- makes clear the relationship between quality and productivity.
- provides a clear way to pursue continuous quality improvement based on the user's definition of quality and the use of statistical theory.
- emphasizes leadership responsibility and offers a system approach to managing work and leading people.
- emphasizes teamwork and cooperation, important to the Department's Sailors and Marines and those who support them in their mission.

Finally, Deming stresses that:

Leaders have the prime responsibility for making system changes, as the essential component of operational commands [Ref. 10:p. 22].

The term TQL, emphasizing "leadership", focuses attention on the enhanced responsibilities of "Command," in a total quality organization. TQL does not alter the traditional responsibilities of line officers or non-commissioned officers. While TQL principles and related methods are

applicable to all systems, operational requirements aboard ship, and combat command environments may involve systems that are different from shore support activities. The application of TQL in the Fleet must address these differences. [Ref. 10:p. 22]

4. The Fleet gets involved

Although TQM/TQL began in the DON shore support establishment, in 1991 Admiral F. Kelso, Chief of Naval Operations was convinced that time was ripe to expand TQL to the Operating Forces by adapting its approach and techniques to the Navy operational environment. He said:

I am convinced TQL can be applied to solve problem areas in ships, squadrons, and shore commands and strengthen our overall performance and readiness. By way of example, take a ship in REFTRA which is having problems setting Condition ZEBRA in an acceptable time. The problem is that, all too often, no one really sits down to analyze the situation - they just say "fix it." With a TQL approach, emphasis instead would be on analyzing the entire ZEBRA-setting process, collecting data to identify causes of problems, and then determining ways to solve those problems. The most important aspect of the Navy's TQL program is support from the top. I am on board and ready to lead the team effort. However, we need to recognize that will be a long-term undertaking which will take years to implement fully.

I want to start now. I am convinced that our emphasis on quality is the right course for the Navy as we sail into perhaps the most challenging sea we have yet encountered [Ref. 13:pp. 30-31].

This paper will explore the success of this venture on a sample of U.S. Navy ships.

5. TQL and the Hellenic Navy

Over two thousand years ago (480 B.C.), in the Naval Battle of Salamis, the ancient Athenian Navy leaders successfully engaged a well discipline, highly trained but smaller Greek Navy to overcome the size advantage of the Persian Navy.

The Athenians had reduced the variation of their people's performance by using unchained Athenian free citizens as rowers during the battle². On the other hand Persians used chained slaves, who served under terrible hardships as rowers which made them inefficient. History has shown that the stable process and quality of people and methods, as well as, the "Profound Knowledge" of Greek leadership about Naval tactics won over the overwhelming quantity of the Persian fleet. This example of quality over quantity remains applicable in the twentieth century.

Nowadays, in the light of a multiple and increased threat in the Balkan peninsula, the Hellenic Navy seeks for better quality for its Naval forces to confront its aggressive neighbors. The fleet wants to ensure that the weapon systems, ammunition, propulsion systems and other elements are of

²The Athenian citizens who did not have money to pay their taxes to the state or who were guilty for criminal acts, could exchange their dues by serving the Athenian Fleet as rowers. They had the privilege to be unchained, both during normal sailing and during the battle. [THUCEDEDES]

predictable high quality and available on time to perform their expected mission.

Moreover, the last modernization with the simultaneous acquisition of modern ships from different suppliers called to develop a homogeneous doctrine of action.

Quality should be the first and foremost determinant of operational readiness. Low demographic indexes among the population and pressure to reduce defense expenditures make it necessary to seek high quality for the Navy forces. High quality processes also are necessary for military personnel operating high technology equipment and weapon systems.

The TQL application might reveal those sectors of the Hellenic Navy where improvements are needed.

B. OBJECTIVE AND RESEARCH QUESTIONS

1. The Objective

The objective of this thesis is to familiarize the reader with how TQL, a concept based on the Quality management philosophy of Dr.W.E.Deeming is being implemented on U.S. Navy ships. Information obtained will be used to assess the applicability of TQL to Hellenic Navy operational commands, and, if value is determined, will suggest implementation strategies.

2. Research Questions

The following research questions will be addressed:

a. Primary Research Question

Is Total Quality Leadership (TQL) as it is practiced by U.S Navy ships applicable to the Hellenic Navy? If so how?

b. Secondary Research Questions

- What is the experience of implementing TQL in U.S. Navy ships?
- How does TQL improve the operational readiness of the U.S. Navy ships?
- What do the U.S. Navy ship experiences tell us about the applicability of TQL to the Hellenic Navy?

3. Scope, Limitations and Assumptions

a. Scope

The scope of this thesis will be to examine how TQL is practiced on U.S. Navy ships, what problems have been faced, how they have been resolved and how TQL might be implemented in the Hellenic Navy. While it is not intended that this study be used as a "cookbook" or "panacea" approach to the implementation of a philosophy as significant as TQL, is expected that the reader and especially the Hellenic Navy as the "customer", can implement TQL more smoothly by adhering to the findings and recommendations discussed in this thesis.

b. Limitations

The foundation of this thesis is five months of concentrated reading and study of current literature available

on TQM/TQL and completing a two(2) credit hours TQL course. Information on U.S. Navy ship experiences with TQL is based on interviews with ship Top and Middle Managers, TQL coordinators and members of the CINCPACFLT TQL team. A questionnaire survey based on Deming fourteen points was given to a sample of crew members on selected ships where TQL is being implemented. A descriptive and statistical analysis of the survey was conducted to assess crews members perceptions of the success of implementing TQL on ships. The results from interviews and questionnaires have been analyzed and assessment of the applicability of TQL for the Hellenic Navy is presented.

c. Assumptions

This thesis assumes the reader has virtually no knowledge of total quality concepts and the U.S. Navy's efforts to implement TQL on U.S. Navy ships. It also assumes the reader will be able to understand the methodology and research tools used in this thesis.

C. ORGANIZATION OF STUDY

Chapter I provides an overview of how U.S. Navy adopted the TQL ,the interface of quality and Hellenic Navy reality and introduces the direction of this thesis.

Chapter II reviews Deming system of profound knowledge and his fourteen points and provides examples of his philosophy.

Chapter III discusses the methodology, the survey and the statistical methods used to analyze the survey and interview data.

Chapter IV presents the data collected and analyzes and interprets it.

Chapter V develops an approach for the Hellenic Navy.

Chapter VI develops a conclusion on the results of the thesis and makes recommendations for future implementation of TQL by the Hellenic Navy.

Appendices, and a list of references located at the end of the thesis.

II. LITERATURE REVIEW

Before we can analyze the implementation of TQL on U.S. Navy ships and examine its applicability to the Hellenic Navy, the reader must understand some of the basic concepts and definitions of TQL, Dr. Deming's Philosophy of Management, some theory of change and DON's approach to introducing and implementing TQL in the operational forces.

This chapter consists of three sections. In the first section the basic definitions such as: process, quality, customer (internal and external), and supplier are given as specified for the military environment. The second section contains a necessarily brief review of Dr. Deming's "System of Profound Knowledge," and his "Fourteen Points of Management." The last section of this chapter develops the DON approach to TQL and emphasizes the prescribed way of implementing TQL on U.S. Navy ships.

A. BASIC DEFINITIONS

The basic definitions are based on the DON definition of TQL mentioned in the first chapter, and conveyed in this chapter in figure 1, which depicts the Total Quality Model. The model shows three fundamental elements. The interconnecting arrows between the three elements show the

communication links that may represent: (a) a decision to accept or reject a product or service (forward arrow), or (b) feedback for product improvement (backward arrow). In the case of the last element, "Customer-perceived" Quality, the solid line of the feedback arrow represents customer information about the quality of the product/service, and the dotted-line feedback arrow represents significant information for future requirements that may yield products not known to the customer [Ref. 1:p. 1-29].

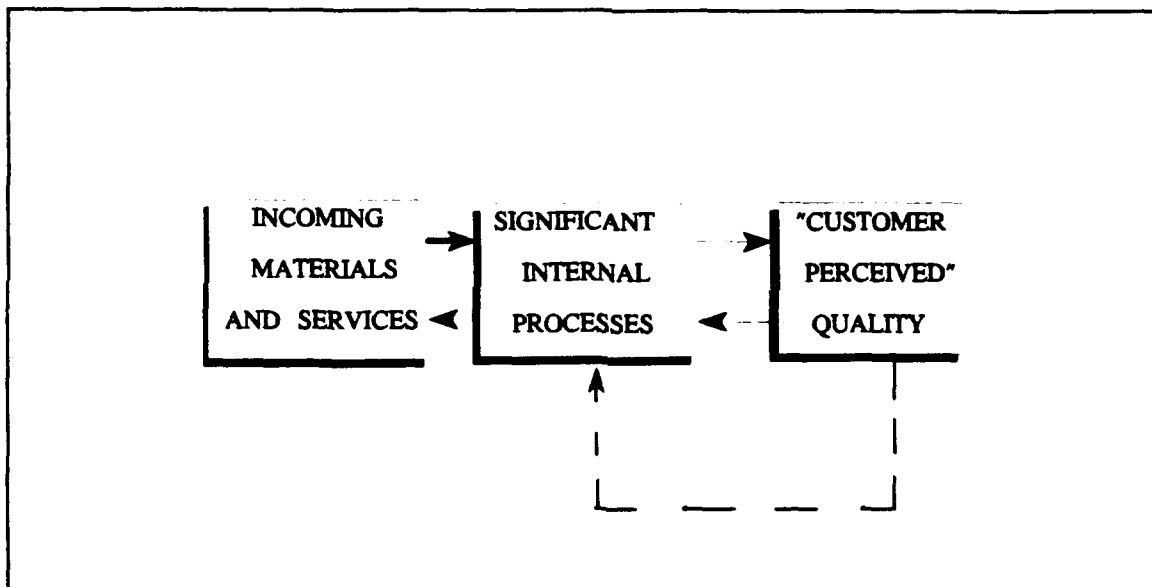


Figure 1: A Total Quality Model

1. Process

The work we do daily consists of processes, every service or product we produce in our organization is the result of some processes. A process can be defined two ways:

"A series of operations or steps that result in an output of product or service" [Ref. 16:p. 1-4].

"A set of causes that work together to produce an effect" [Ref 1:p. 2-15].

"In other words Process is the blending of several causes (inputs) that work together to produce a desired effect (outcome)" [Ref. 1:p. 2-16]. The production of an accurate navigation position requires the coordination of the following variables: equipment, methods, materials, and people. The blending of equipment (Sextant-NTDS-Radar), methods (Satellite-radar-coastal shipping), materials (star tables-charts) and people (navigator-watch personnel-skills) results in an output (navigation position). An output is some product or service which meets the customer's (in this case, Commanding Officer) needs at a price the customer is willing to pay.

There are a number of processes associated with operating a ship, such as;

- Preparing a report
- Loading ordnance
- Dropping anchor
- Lighting-off the propulsion system
- Purchasing supplies
- Gunfiring
- Training people
- Transporting hazardous materials
- Preparing a budget

According to Deming, there are two types of processes within an organization; internal and critical. An internal process focuses on the activities required to get the job done without regard to the end product and user. Its main flaw is that although it can efficiently produce goods and services, they may not be what the customer wants. Critical processes focus on the mission accomplishment of the organization. They emphasize quality of the end product to meet the needs of end users, while, at the same time, optimizing the organization's resources. Leaders of an organization are responsible not only for promoting process improvement throughout the organization, but for managing those processes which are important to the mission of the organization [Ref. 1:p. 2-15]. Therefore, an important difference between managing the old way and leading under TQL is that TQL focuses on improving the process instead of inspecting the product results and scrapping or reworking rejects.

2. Supplier

Suppliers are the persons or organizations who precede the series of tasks of a process [Ref. 17:p. 2-5]. There are external and internal suppliers. External suppliers are the people outside the organization who sell materials, information, or services to the organization. For example, a shipyard depot, superior or inferior commands, and other ships are the external customers for a ship. Inside the ship,

enlisted personnel receive work passed-on from other people called internal suppliers. For example, the CO gets information for the crew's daily activities by the XO who is his supplier. The XO has previously been briefed of the crew's activities by his supplier, the Command Master Chief [Ref. 17:p. 2-5].

3. Customer (end-user)

Dr. Deming uses the term "user" to describe two types of customers in the following manner:

External customer--These are the real customers in the sense that they are the ones who use the products and services, and so they determine whether or not an organization stays in business.

Internal customer--Internal customers are those individuals in the organization who develop a product or service. Each person in an organization receives a "product" from the preceding operation or step. The product could be raw material, or a subcomponent of a larger product. Each person alternately and continually, becomes both a customer and a supplier [Ref. 1:p.1-10].

Therefore, although every internal customer (user) is equally important in the development of the product, the ultimate focus for any organization must be the external customer (end-user). For example, external customers for a helicopter training squadron are the pilots who receive training, the ships or other Hello squadrons who receive the trained pilots, and the fleet commander. On the other hand, an internal customer within a ship could be the Commanding Officer who receives a report from the operations department

head, or the air-track recorder in the CIC who gets information from the radar operator.

A customer feedback system, depicted by the solid and dotted lines between the "significant internal processes" and "customer perceived quality" boxes in the total quality model (see Figure 1), is essential for developing an organization's system of communication. It allows both organization and customer to stay in constant touch with each other. Customer feedback should be active, on-going and contain meaningful information [Ref. 1:p. 1-32].

B. DEMING'S APPROACH TO QUALITY MANAGEMENT

Dr. Deming defines quality in terms of current and future needs of the customer. According to Deming:

The difficulty in defining quality is to translate future needs of the user into measurable characteristics, so that a product can be designed and turned out to give satisfaction at a price that the user will pay [Ref. 2:p. 169].

Part of Deming's philosophy can be depicted by what he calls the chain reaction for quality improvement. By improving quality, costs decrease and productivity improves. As a result, there is a greater potential for an increased market share [Ref. 10:p. 10].

He points out that organizations use two general methods to achieve quality. Inspection for defects - the dominant method used by most U.S. companies, and process improvement for the prevention of defects - Deming's prescribed method.

In the former, quality is checked after the end-product is

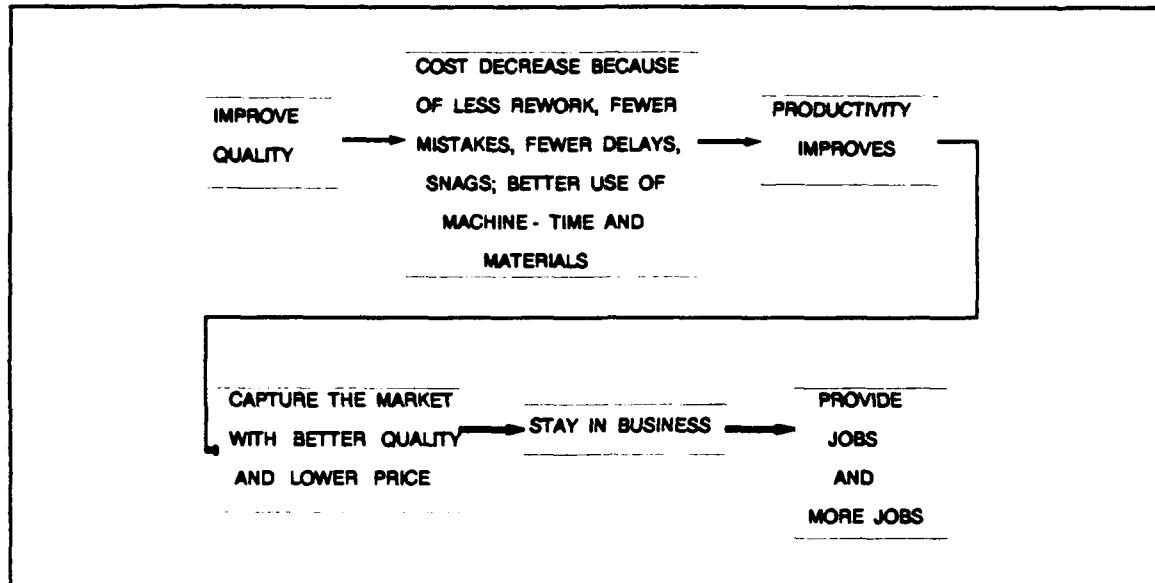


Figure 2: Deming's Chain Reaction for Quality Improvement

produced and may result in considerable additional costs, such as; rework on defective products, employee burnout, delays in delivery and need for more inspectors and troubleshooters. In the latter, although there are up-front costs in training and production time, the job is constantly improved and, in the long-term, results in a more cost-effective and quality product.

Deming also emphasizes statistical thinking and methods. Additionally an understanding of what he terms, "Profound Knowledge" is essential to his approach to quality.

1. Profound Knowledge

Dr. Deming's approach to quality leadership is based on his System of Profound Knowledge. The System of Profound

Knowledge consists of four interrelated parts: Systems Theory; Variation; Psychology of Individuals, Organizations, Learning and Change; and Theory of Knowledge. The purpose of the system of "Profound Knowledge" is to provide knowledge that leads to understanding of how to improve quality. Deming repeatedly uses the phrase, "There is no substitute for Knowledge." By this he means a system of Profound Knowledge. [Ref. 1:p. 2-4]

a. Systems

Dr. Deming defines a system as "a series of functions or activities within an organization that work together for the aim of the organization" [Ref. 1:p 2-6]. When we analyze the organization as a system it encompasses three subsystems; (a) the technical subsystem that involves manpower, methods, machinery, materials, etc., (b) the political subsystem which deals with how power distributed in the organization (who makes the decisions, who controls the resources and who makes the distribution of resources), and (c) the culture. Culture deals with the way things are done in a particular organization, what is taught to new members about how people are treated, and the "norms" of the organization. [Ref. 18:p. 8]

A ship is a brilliant example of a system. It consists of different departments that interact with each other to promote operational and combat readiness. When the performance of any part starts to degrade or fails outright,

the overall effect on the ship system can be disastrous. It can result in low morale of the crew, an inability to fight in a battle and may ultimately cost it its survivability. Some departments are more important to the ship at one time than others i.e., (Weapons vs Supplies) or (Propulsion System vs Electronics Department), but they are all necessary for optimal performance of the ship as a system.

Dr. Deming also states that;

Management of a system requires Knowledge of the inter-relationships between all the sub-processes within the system and of everybody that works in it. Moreover a Leader must understand that the system is composed of people, not mere machinery, nor activities, nor organization charts.

He continues that "the performance of any sub-process should be evaluated in terms of its contribution to the aim of the system, not for its individual production or profit." [Ref. 4:p. 151]

Deming strongly believes that "management's job is to optimize the system" [Ref. 4:p. 152]. For optimization to occur, he tells us a system must be managed. This requires prediction and flexibility to be ready to change the boundaries of a system to better serve the aim [Ref. 1:p. 9]. For example the navigator makes changes in the course of the ship based on the changes in weather conditions, traffic, shallow waters, wrecks, etc. Likewise, leaders must be able to anticipate the needs of the customers for new products and

services and improvements to existing products/services and processes.

b. Variation

A law of nature states that there is variation in everything. Thus variation must affect the processes that make-up the organizational systems. Dr. Deming states that if leaders and workers want to improve their systems then they must have some knowledge about variation [Ref. 4:p. 151]. For example, in a gun-firing exercise what causes variation in the dispersion of hits around the target? Possible causes of variation could be due to the percentage of gun barrel corrosion, weight of powders in cartridges(material), the skill of gun handler (people), the reliability of fire control system (machine), or the methods being used to acquire and track the target (methods).

Dr. Shewart, a statistician in the 1920s, laid the ground work for studies in variation. He discovered that in repeated measurements on the same process outputs there was a distribution of values. He identified that process causes (machines, methods, materials, people) are the factors causing variation within a process. Dr. Shewart classified the causes of variation as "chance" and "assignable."

Deming took Shewart's logic one step further and used terms that indicated who was responsible for taking action to improve matters. Dr. Deming re-classified "chance

causes" as "common causes," which are a part of the process or system; and "assignable causes" as "special causes," those causes that happen under special circumstances and do not belong to the system. "Common cause" variation, as part of the system, can be reduced only by the leadership, working on the process to effect a permanent change to the system. On the other hand, special cause variation is the result of some unusual situation and easier to identify. Special causes can be removed by subordinates because of their direct involvement and day-to-day familiarity with the operational process - they work in the process.

An example of common cause variation is the magnitude of gunfiring dispersion per firing. If the results are not within standards, the Weapon officer can change the method of gunfiring to obtain desirable objectives - not the subordinates. Special cause variation can be a faulty setting of ballistic data in the computer of the fire control system; easily correctable by the operator of the computer.

A process or system that has only common causes affecting the outcome is called a "stable process," which implies that the variation in the outcome is predictable within statistically established limits (upper and lower). A process whose outcomes are affected by both common causes and special causes is called an "unstable process." It is called unstable because its magnitude of variation is unpredictable [Ref. 9:p. 29]. Shewart developed, and his colleague, Deming,

adopted and used control charts to depict variation pictorially and to attempt to determine if the observed variation was common or special.

Deming stresses that:

A system may be stable, yet turn out faulty items and mistakes. To take action on the system in response to production of a faulty item or a mistake is to tamper with the system. The result of tampering is only to increase in the future the production of faulty items and mistakes, and to increase costs - exactly the opposite of what we wish to accomplish [Ref. 17:p. 2-15].

For example, if the boilers of the propulsion plant in a destroyer lose a constant volume of water, outside specifications, and in trying to correct the system we cause it to lose an even greater volume of water, we are tampering. We need to reconsider our repair process in order to achieve the desired outcome - improve the quality in performance of the boiler, closer to specifications.

c. Psychology

Dr. Deming has given attention to the study of psychology. Since a process moves through different functional departments of an organization, groups of people must learn to communicate with each other in order to work together in new ways. This requires an understanding of the psychology of individuals particularly how they learn and adapt to change [Ref. 1:p. 4-2]. Management needs to have knowledge of people and how they interact, of their individual needs, and of their working and learning styles. People are different from one

another, and management's responsibility is to be aware of those differences, and use them to optimize performance [Ref. 10:p. 8].

The switch to a pursuit of total quality leadership means change. Transformational change includes the organization's culture, as well as personnel's attitudes change. The amount of change will vary from organization to organization. In addition, all leaders must continue to improve their leadership skills throughout their careers. Some people seem to resist change--although others would argue that people are not resistant to change. Why the resistance? Basically, people have a natural fear of the unknown; of uncertainty. Change causes uncertainty. People ask themselves: What will happen to me if there is a change?, Will I be better-off or not? Are they trying to get rid of me? The fear of change is universal--it applies to all people.

In order to alleviate or reduce these fears and to effectively implement change there must be leadership. These changes will not occur without leadership. Leaders at every level must focus on working as teams, to communicate effectively with each other and to effect a cultural transformation in the organization [Ref. 1:p. 4-14].

d. Theory of Knowledge

The fourth part of Profound Knowledge addresses the way in which knowledge is advanced. The theory of knowledge is

reflected in the scientific method, a method used to advance the state of knowledge in any given field. The method requires formulating a theory, testing the theory, explaining the results or events and predicting future results or events based on the theory. The method also requires collecting, analyzing, and interpreting data about the theory under consideration. [Ref. 1:p. 5-5]

Deming has developed a method for continuous process improvement, known as PDCA cycle(Plan Do Check Act). According to Deming, this method allows managers to make predictions based on knowledge. Traditional management approaches to planning and decision making such as: crisis management, shoot from the hip, form tiger teams, blame the workers, take short-term perspectives, and work around the system are not appropriate for practicing total quality. [Ref. 1:p. 5-8]

The transformation from traditional management practice to TQL cannot happen without planning. Planning requires prediction, and prediction can be based only on the current state of knowledge.

Effective leaders must be able to make predictions. An example is the military concept of "know your enemy." In combat, the more a leader knows about the enemy (historical strategies and tactics, logistics, weapons capabilities, size of forces, strengths and weaknesses, and so on), the better will be his ability to predict what the enemy will do. The more accurate the prediction, the more effective the battle planning and operational decision-making can be. [Ref. 1:p. 5-14]

2. Deming's 14 Points of Management

Deming states that "the Fourteen Points are a roadmap to change" [Ref. 1:p. 7-4]. The ultimate objective is to accomplish all 14 of these obligations of management. We cannot choose to adopt some of them and ignore the others. On the other hand, we do not have to accomplish them all at once [Ref. 1:p. 7-3].

The fourteen points are principles that apply to all organizations: To small organizations and large ones, to service industries and to manufacturers. They apply to each division within a company. They apply to public and private organizations and to military and civilian organizations [Ref. 1:p. 7-4].

- **Point 1: Create and publish to all employees a statement of the aims and purposes of the company or other organization. The management must demonstrate constantly their commitment to this statement [Ref. 1:p. 7-5].**

Deming notes that a company must have a plan for the future to stay in business [Ref. 3:p. 55]. Such a plan implies that quality is a constant priority. According to Deming, leadership has the obligation to establish "constancy of purpose," and all the policies and practices of the organization must be consistent with the purpose [Ref. 1:p.7-5].

Establishing constancy of purpose means 1)innovation; 2)research and education; 3)continuous improvement of product and service; 4)maintenance of equipment, furniture and fixtures, and new aids to production in the office and in the plant[Ref. 3:p..56].

The top leadership is responsible for developing a long-range vision for the organization which will reflect the continuous pursuit of quality and innovation.

For example, some commanders dedicate themselves and focus their efforts on finishing projects during their watch. Such activities result either in personal satisfaction for the commanders, but frustration, dissatisfaction and degradation of morale for the crew, or suboptimization of the ship's mission due to neglect of other equally important long-run goals.

- **Point 2: Learn the new philosophy, top management and everybody [Ref. 1:p. 7-8].**

McConnell writes:

The new philosophy is the optimization of every process within companies, and within industries, to provide product and service that is maximally useful at lowest possible cost [Ref.4:p.168].

According to Deming, we must adopt quality as our ultimate aim. To attain quality we need a clear vision of what we want and a clear organizational strategy [Ref. 1:p. 7-8].

At the present time;

The Department of the Navy is affected by the general economic conditions in the United States and the worldwide changes. It is also experiencing radically declining budgets and personnel. We cannot afford waste or rework at any level. We must adopt a philosophy that emphasizes quality. The DON must provide the best defense possible within the budget provided by Congress [Ref. 1:p. 7-8].

- **Point 3: Understand the purpose of inspection, for improvement of processes and reduction of cost [Ref. 1:p. 7-11].**

Deming states:

Inspection of a product, with the aim of finding the bad ones and throwing them out is too late, ineffective, and costly. Quality comes, not from inspection, but from improvement of the process [Ref. 2:p. 29].

For example, in Navy propulsion plants, if several different watch-standers are responsible for checking the same valves during a light-off, each person may feel it is OK to skip the check because someone else will catch it [Ref. 1:p. 7-12].

On the other hand Deming points out that, as a practical matter, a certain amount of inspection will always be required, if only to find out what you are doing [Ref. 3:p. 60]. Basically, "inspection - or review - is necessary for reasons of safety, or to avoid embarrassment and sometimes even for minimum total cost" [Ref. 2:p. 30].

Inspection has its place, particularly in military activities. For example, inspection of weapon systems before a gunfiring is necessary to diminish the probability of an accident. Releasing an overhauled submarine without diving tests would be potentially catastrophic.

- **Point 4: End the practice of awarding business on the basis of price tag alone [Ref. 1:p. 7-14].**

Deming stresses that:

Price has no meaning without a measure of the quality being purchased. Without adequate measures of quality, business drifts to the lowest bidder, low quality and high cost being the inevitable result[Ref. 2:p. 32].

A common practice in the DON and in the private sector is to buy materials and services from the lowest bidder to keep costs low. Usually, the cost of purchase is not the same as the total long-run cost. For example, the sailor going into battle may find little satisfaction and feel insecure, knowing that his equipment was supplied or repaired by the lowest bidder [Ref. 1:p. 7-14].

- **Point 5: Improve constantly and forever the system of production and service [Ref. 1:p. 7-19].**

According to Deming, management must lead the way to improve quality by reducing process variation [Ref. 3: p.66]. Scherkenbach notes that the Plan, Do, Check, Act cycle is the main paradigm of a method for constant improvement, and he identifies the steps as following; a) Recognize the opportunity, b) test the theory, c) observe the test results, d) act on the opportunity, which connects back and continues at step (a).

He also stresses that customer feedback drives the continuous improvement [Ref 1:p. 7-20].

The leaders of an organization must constantly and forever improve the systems they control and push information

up the chain of command to help higher levels identify barriers that stand in the way of continuous improvement [Ref. 3:p. 20].

Leadership must change from the attitude of "if it ain't broke, don't fix it" to an attitude of "we are better today than we were yesterday but not as good as we will be tomorrow" [Ref. 16:p. 2-15].

For example, what is considering effective weaponry today may be unacceptable tomorrow due to equipment innovations. This points up the need for continuous improvement [Ref. 1:p. 7-20].

- **Point 6: Institute training (for skills)** [Ref. 1:p. 7-22].

Changing organization systems without providing training will not lead to continuous improvement. Organizations sometimes offer no or little formal training. Many organizations institute on-the-job training which means new workers learn their jobs from other co-workers or predecessors who themselves may have never been properly trained. Deming notes that this way of training contributes to greater variation in the process. On the other hand, the training should not end as long as performance is not yet in statistical control and there is something to be gained [Ref. 3:p. 68]. Deming also stresses that training must be done by those who have an expert knowledge of the job. The trainer should have not just an understanding of job's requirements but be required to have a knowledge of the meaning of the job. A leader who serves as the trainer should be a highly skilled

performer of the job who can teach others to understand the job. He must be able to explain not give orders. [Ref. 1:p. 7-23]

Following is an indicative example for the practice of worker-training worker. A new enlisted gunmate embarking onboard the ship is placed under a master chief as an apprentice. As the apprentice masters new skills he progresses in the hierarchy until he is considered a master chief. He then becomes responsible for training another apprentice gunmate. During this cycle of changing roles there is a certain degradation in training. That is, there is no guarantee that a master has the skills to teach and pass on his skills to a new shipmate. In addition, with this type of training, it is possible that updates in procedures and improvements in standard training will not be known and therefore not be implemented in the gunner's processes.

Another area of training which must be given emphasis is multi-skill training:

The multi-skilled labor force is becoming more common. Leaders have the responsibility for developing a policy of cross training and for retraining employees in new technologies and skills to help them keep up with changes. Organizations of the future will require workers to know more of the process than they do now. For example submarines require multi-skilled sailors. The small space on a submarine limits the number of people who can be aboard. It also limits the number of people who can specialize in only one skill. Cross training allows for more flexibility in a fast-changing work environment and enables other sailors to replace an injured sailor during an emergency. [Ref. 1:p. 7-25]

- **Point 7: Teach and institute leadership [Ref. 1:p. 7-26].**

Leadership is the job of management. Deming believes that leadership has the responsibility to discover the barriers that prevent workers from taking pride in what they do [Ref. 3:p. 70].

Leadership in an organization should act with the following principles:

Lead the quality transformation by developing profound knowledge and modeling the "new" behaviors. Help the organizational members do a better job by establishing a goal to pursue quality, and by providing the resources to accomplish the goal. Lead by example, take actions which focus on the long-term health of the organization vice meeting short-term goals and quotas [Ref. 16:p. 2-15].

For example, any leader in the Navy must first be proficient in his job and be knowledgeable of the proficiency and skills of his subordinates. Sailors come to the ship with different levels of knowledge and skills, and sometimes conflicting personalities attitudes, and ideas. A leader has the responsibility to manipulate these individual differences in order to optimize the effectiveness of the ship. The leader who always tries to direct everything, often without sufficient knowledge of the work, versus the leader who is proficiently knowledgeable on the job, and comes to work ready to help his people do a better job, has a significantly higher probability for failure and suboptimization of his department and the ship as a whole.

- **Point 8: Drive out fear. Create trust. Create a climate for innovation [Ref. 1:p. 7-30].**

Scherkenbach writes in his book "The Deming Route" that:

Deming has found that the removal or reduction of fear should be one of the first of his fourteen obligations which top management starts to implement, because it affects nine of his other points [Ref. 14:p. 75].

Deming also states that "fear is expensive, it increases costs" [Ref. 2:p. 60].

Fear increases costs because people spend a lot of time (wasted labor hours) engaged in activities that are not in the best interest of the organization. Such activities include talking to one another trying to figure out what is going on, trying to support one another when leaders "punish" them for events they could not control, and so on [Ref. 1:p. 7-31].

In the military environment very often the authoritarian way of management creates fear in the subordinates which can ultimately jeopardize the survival of the organization.

For example, a sailor who discovers a mistake in his job and knows his supervisor does not accept or excuse any mistake obviously will try to keep the mistake secret. Sometimes hidden mistakes are so serious they can affect the survivability of whole the ship.

- **Point 9: Optimize toward the aims and purposes of the company, the efforts of teams, groups, staff areas, too [Ref. 1:p. 7-33].**

By this point Deming implies that leadership should: Promote communication, cooperation and teamwork. Establish linking structures that cause this to happen. Breakdown

barriers which prevent organizational members from perceiving downstream users of their outputs as customers. Encourage win-win thinking. Focus improvement efforts on better meeting or exceeding the needs of internal, as well as, external customers [Ref. 16:p. 2-15].

For example, while a ship was on dry-dock for intermediate maintenance the XO decided to paint the ship in a short period of time by using a large number of personnel. However, when his subordinate department heads provided the requested personnel, the XO realized that there were not enough paint brushes, paint and other needed supplies to get the job done. In trying to acquire the needed supplies, precious time was lost in the dry dock and other ships scheduled for maintenance were also delayed. The XO's failure to adequately scope the job, use teamwork, and communicate effectively his plan resulted in wasted resources and frustration among the staff of the ship who was trying to successfully complete the mission.

- **Point 10: Eliminate slogans, exhortations, and targets for the workforce [Ref. 1:p. 7-37].**

Deming tells us that we must understand and accept that people are doing their best. Exhortations (slogans) by themselves do not help people do their job better [Ref. 2:p. 62].

What is wrong is the use of exhortations and targets when they call for increased levels of productivity but do not provide a method to achieve the new levels. Such slogans are example of leaders "hoping without helping." Such targets without methods are ineffective [Ref. 1:p. 7-37].

Deming also suggests that:

Slogans are aimed at the wrong people, that it would be more appropriate for leaders to exhort themselves to perform better by setting goals for such items as quality leadership and process improvement [Ref. 1:p. 7-39].

For example, in order to promote superior performance and esprit de corps onboard the ship the captain had mounted a slogan in the officers wardroom that read "WE ARE SECOND TO NONE." In reality, that ship had performed below average in its flotilla training exercise and the captain's fighting spirit was not shared by his officers. What had happened? Although the Commanding officer wished for his ship to be second to none, his actions had handicapped and hampered his officers from living up to his desires. The CO had disapproved requests to send his officers to various educational and training seminars outside the ship because he believed that his officers would waste their time in what he considered to be secondary activities. As an authoritarian leader, he expected his officers to be proficient in their jobs and believed in punishment of his officers who performed below his standards - even though he did not provide for their training.

- **Point 11: (a) Eliminate numerical quotas for production. Instead, learn and institute methods for improvement. (b) Eliminate Management by objective. Instead, learn the capabilities of processes, and how to improve them [Ref. 1:p. 7-40].**

Deming In Point 11a, Deming states that standards and quotas are arbitrary if they are developed without knowledge of process capability. Leadership should stop rating people

based on its or someone else's wishes, hopes and dreams of what they can produce [Ref. 16:p. 2-15].

For example, a flotilla commander during an anti-submarine search action, under severe weather conditions, insisted on continuing the action even after his staff had proven that the flotilla did not possess the capabilities necessary to find the submarine - and further search was futile. Even when his staff recommended that air support was required to find the submarine, the commander insisted - believing that if the flotilla made numerous sweeps over the target area it would eventually find the submarine without air or other additional resources. Perhaps based on his experience or not wanting to give in to his staff, he didn't like re-examining the current methods and tactics to improve the process of detecting a submarine.

Point (11b) calls for the elimination of M.B.O. (management by objective) for assessing managerial performance. Quite often leaders sit down with their subordinates and set various objectives with numerical goals. Without examining how the departments are affected by such decisions. Under the Management-by-Objective system there is the danger of conflicting objectives among the department heads which can produce competition; creating win-lose situations that will ultimately suboptimize the organization. M.B.O., as practiced in most organizations today, often fosters internal competition (which leads to suboptimization)

instead of cooperation. The atmosphere established by such practices is not consistent with process improvement or with win-win thinking. [Ref. 1:p. 7-41]

For example, prior to an inspection, the engineering department requests all new hoses from the supply department, in order to make a good impression with the inspectors. If the supply department, however, fills this large order, it will be short of its prescribed stockade list - a very undesirable position to be during an inspection. Therefore, a conflict arises among these two departments who have lost the focus of the ship's immediate mission, i.e. to successfully pass the inspection, and instead are focused on their own departments success - management-by-objective.

- **Point 12: Remove barriers to pride of workmanship [Ref. 1:p. 7-43].**

According to Deming:

Leadership must allow people at all levels to experience pride of workmanship and pride in the organization vice experiencing apathy, frustration and estrangement. Develop process ownership and delegate authority to the lowest appropriate level. Recognize and nurture peoples' needs for self-esteem, and respect [Ref. 16:p. 2-15].

Scherkenbach writes that performance appraisal systems actually increases the variability of peoples' performance.

The people who are ranked below average try to emulate those who are ranked above average or otherwise change what they are doing to get a better rating or to improve. Because about half of the people are trying to change to become above average, the variability of the outcomes of the organization can increase to twice what it would be if they would have just continued what they were doing. [Ref. 14:p. 53]

For example, the ship's "damage control" department consists of sailors who are taken from the different departments in the ship. The majority of them are sailors who have conflicts in their departments or perform below average. They can be characterized as "persona non grata" or undesirable in their own departments and are gladly pushed-on to the damage control department. Although these sailors know that they are looked upon as the lowest echelon by their peers, some often perform above the expectations once they are integrated in the damage control department. This occurs because they have a new opportunity and a new environment to prove their capabilities in workmanship.

- **Point 13: Institute a vigorous program of education and retraining [Ref. 1:p. 7-48].**

Deming points out that:

Leadership must help everyone pursue knowledge and prepare themselves for the changing future. Furthermore must motivate people-individuals and teams by recognizing/rewarding efforts [Ref. 16:p. 2-16].

Education/training can be very innovative. The traditional way of training the crew of a new ship in the Hellenic Navy has been to train onboard the ship's systems after the ship has been received. Recently however, when a new ship was ordered from a foreign shipyard, the training of the crew was included in the contract. The crew was trained in the new technologies through simulation and classroom instruction, while the ship was being built. When the ship was completed

the crew was fully trained and was able to begin its mission without much delay.

- **Point 14: Take action to accomplish the transformation [Ref. 1:p. 7-48].**

According to Deming, leaders in an organization:

must practice quality leadership to build and expand the critical mass and begin the quality chain reaction. Foster innovation and improvement in everyone; coach and counsel vice judging [Ref. 16:p. 2-15].

To achieve the full potential of TQL, everyone in the organization will need to participate. A sense of community must be developed so that everyone understands and believes "we are all together." The transformation is everyone's job [Ref. 1:p. 7-52].

C. DON APPROACH TO TQL

The Department of the Navy's (DON) approach to Total Quality evolved in the early 1980s with aviation depots and naval shipyards. Since 1991, TQL has been implemented in operational forces, such as ships and aviation squadrons.

The DON focused on quality because it was facing rising costs, dwindling budgets, and reduced manning levels while its operational requirements increased or remained constant. Therefore it was forced to become more efficient in its processes to maintain operational readiness. [Ref. 1:p. 1-19] Adoption of the total quality concept by DON represents a long-term commitment to increasing quality of goods and services [Ref. 1:p. 1-24].

In accordance with the first of Deming's 14 points, "create constancy of purpose" DON has issued its vision, guiding principles, and strategic goals. The strategic goals, address five areas: 1) integration of Navy-Marine Corps team; 2) human resources, education, and training, 3) acquisition; 4) innovation and technology and 5) facilities.

Before we go through DON approaches TQL is necessary to review the DON structure as a traditional organization.

1. DON as Traditional Organization

The traditional DON organization is hierarchical in its structure with vertical links through the chain of command.

This type of structure has survived historically because it has been the most effective way to transmit the message of the leader down through the organization, and this downward communication has been extremely necessary and effective during combat when time and control are required [Ref. 1:p. 2-29].

In peaceful times this organizational structure can create problems such as:

a. One-way top-down communication

The traditional hierarchy creates one-way communication from top - down, as well as, barriers to upward and cross-functional communication. In the DON communication usually flows between the CO and the department heads, as well as, between the department heads and their own divisions [Ref. 1:p. 2-30]. Although there is two-way communication between the CO and his department heads, this hierarchical system does

not promote communication between the departments, creates barriers to upward communication/feedback, and prevents the sharing of information between departments. Thus, a lot of critical information stays within the departments, resulting in suboptimization of the organization and frustration among the workers.

b. Impedes the aim of the system

Each department functions like a separate entity and tries to preserve its own life and privileges. People do not consider how the actions of their department affect the other departments. This results in sub-optimization of the organization as a whole. [Ref. 1:p. 2-30]

c. Reduces sense of ownership

Managing by department eliminates the ability of workers to see their individual contribution to the whole product or service. Furthermore, when work is fragmented, workers feel that their efforts have little or no effect on the product that goes to the customer. [Ref. 1:p. 2-31]

d. Encourages "we-they" thinking

Under the traditional organization structure, workers are both physically and organizationally separated. Due to lack of easy communication the suppliers do not know the needs of their customers, albeit they do their best. Thus they are lead to "we-they" thinking which causes hostility

between departments blaming each other for bad products. [Ref. 1:p. 2-31]

e. Increases cost of supervision

Traditionally, supervision considers that individual workers have limited knowledge of the process. Thus, a supervisor needs more time to oversee both quality and process flow. In the DON, a supervisor has many significant tasks, and if he also has to oversee both the quality and the process flow he will not be able to focus on problem areas and on other critical processes. His constant supervision and interference would also discourage workers from exercising initiative in their work. [Ref. 1:p. 2-32]

f. Reduces flexibility to respond

The bureaucratic structure is very rigid and inflexible. Managers are trying to enforce accountability through the structure, even though the problem could be in the process. They also try to determine functional accountability when the problem could be at the interface of the functions. People who are working on the process and try to improve it, meet barriers in communication because the traditional structure lacks the required flexibility. [Ref. 1:p. 2-32]

It is apparent that the traditional structure sets-up barriers to process improvement. As DON seeks continuous improvement, it wants to push the different departments to "focus across the process and work together in cross-

functional teams toward common goals." [Ref. 1:p. 2-32]
Moreover, it needs a parallel structure that allows: (1) the

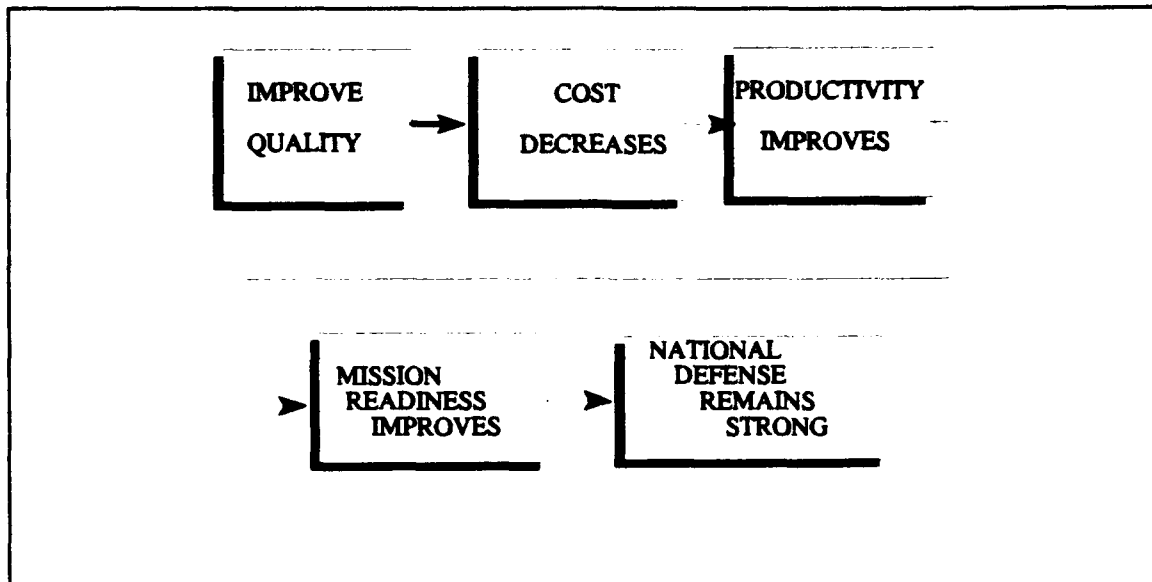


Figure 3: The Chain Reaction in the DON

chain of command to be maintained, (2) the organization's focus to be process-oriented, (3) the organization to be linked vertically and horizontally for communication and decision-making [Ref. 1:p. 2-32].

2. The Chain Reaction in the DON

Dr. Deming has some thoughts about how quality ties in with government service.

In most governmental services, there is no market to capture. In place of capture of the market, a governmental agency should deliver economically the service prescribed by law or regulation. The aim should be distinction in service [Ref. 2:p. 6].

Deming's Chain Reaction model mentioned in section B, and adjusted for DON's needs predicts that as quality

improves, costs decrease and productivity increases (see Figure 3). Lower costs and higher quality lead to an improvement in mission readiness.

3. The Transformation in DON

The top leaders in the DON are committed to quality improvement as the primary strategy for improving mission performance and readiness. They have adopted a TQL education and training program which is designed to provide the skills and knowledge necessary to start the transformation and application of TQL philosophy and methods. The education and training strategy established to support TQL implementation in the DON consists of the following elements:

- Educating Senior Leaders
- Building Critical Mass
- Creating a Cross-functional Team Structure
- Creating Strategic Focus

a. Educating Senior Leaders

TQL implementation is led by the Commanding Officer and the Executive Officer. For that reason there is a senior leaders' course. In this seminar, senior leaders learn about the three jobs that they have to do - create critical mass, start process improvement, and begin to lead the transformation.

b. Building Critical Mass

Deming said that the change to a total quality approach cannot be done by top leaders alone. They must develop a "critical mass" in the organization--people who understand how to focus on quality. A definition of Critical Mass is the following: "Those people within an organization who possess sufficient knowledge, power, and leadership to initiate and sustain a cultural change." [Ref 1:p.2-51]

The critical mass is the catalyst required to begin the organizational transformation. The elements must include leaders with the vision to show the way, and enough people who have influence in their sectors of the organization, and know what to do. A change to total quality must involve all those people in the organization who:

- Have power through their positions and influence.
- Understand the meaning of Deming's 14 points and have some appreciation and understanding of Profound Knowledge.
- Are willing to lead the change effort.

The people who are involved in the critical mass must come to understand the meaning of the 14 points, as well as, to have some appreciation and understanding of Profound Knowledge. The critical mass must consists of enough people with enough knowledge to start the TQL so that by the time the Leader leaves, it will not die. [Ref. 1:p. 2-51]

c. The Quality Improvement Team Structure

DON achieved the transition to TQL philosophy by organizing around the process quality improvement teams. The use of teams is significant for implementing TQL. Each team is composed of all the people involved in a process, which means it can come-up with more effective improvements than a single individual. Figures 4 and 5 graphically show how these crossfunctional teams are organized. They will be explained in the following sections. The DON has chosen to follow a

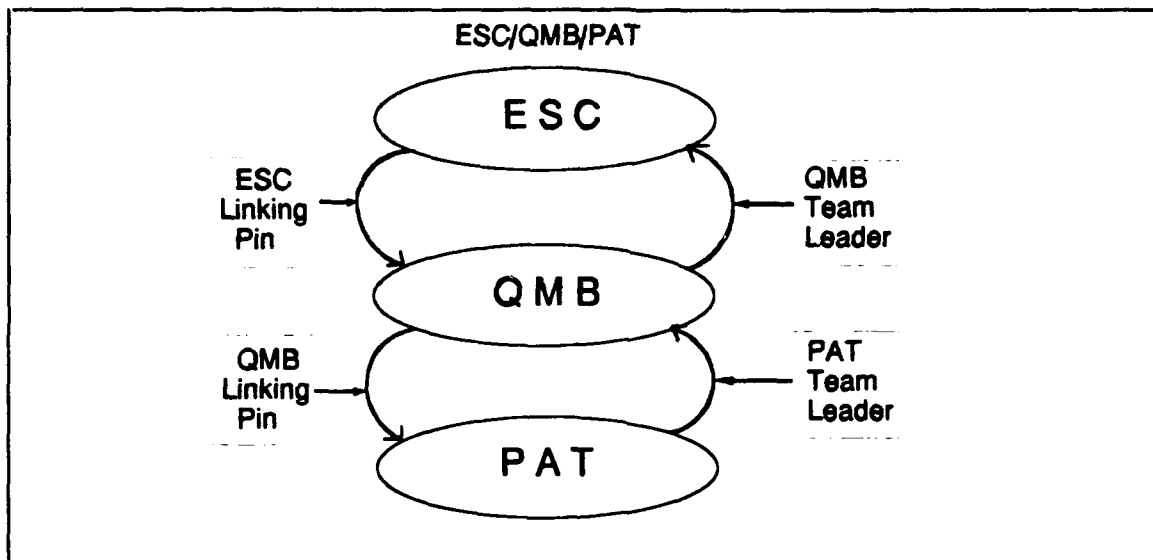


Figure 4: Crossfunctional Structure

structured approach to implementing TQL consisting of three types of TQL teams: the Executive Steering Committee (ESC), Quality Management Boards (QMB), and Process Action Teams (PAT).

Team approach complements the traditional organizational structure by increasing the interaction and cooperation

between departments. The chain of command is still preserved. In fact, power comes to the teams by the authority of the chain of command, but the focus is on the process. The quality Improvement Team structure also gives the workers a sense of process ownership and identity, creating a more fulfilling and happier work environment [Ref. 1:p. 2-32].

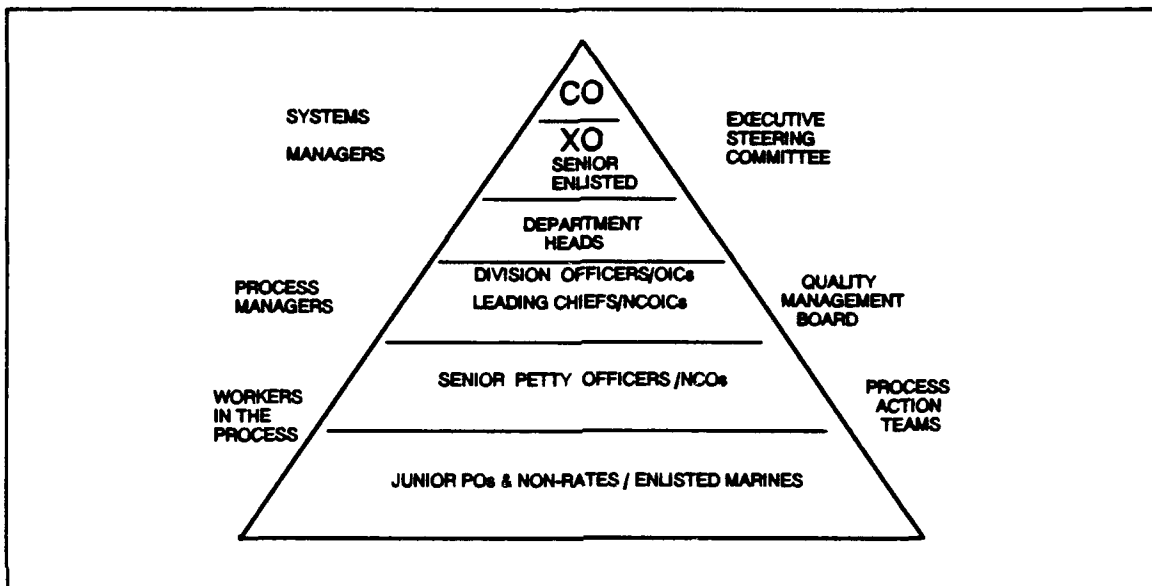


Figure 5: Crossfunctional Team Membership

(1) *Executive Steering Committee (ESC)*. The Executive Steering Committee consists of the top leaders of the organization, i.e. CO, XO, department heads, Command Master Chief, special assistants, etc. The ESC is responsible for:

- Leading the transformation of the organization
- Educating the critical mass
- Implementing TQL by developing and adopting the new quality philosophy. This philosophy includes the mission statement, the organization's guiding principles, and the strategic objectives.

- Identifying external customer requirements
- Identifying processes
- Chartering Quality Management Boards
- Providing resources and decision support [Ref. 12:p. 3-5].

(2) *Quality Management Boards (QMBs)*. QMBs are composed of mid-level managers from different departments within the organization who work together on improving significant processes that they "own." QMBs are responsible for:

- Identifying and prioritizing critical processes
- Initiating process analysis
- Chartering Process Action Teams
- Providing resources and decision support
- Evaluating effects of process changes
- Recommending major process changes to ESC
- Delegating authority to empower PATs to make process improvement changes [Ref. 12:p. 3-6].

(3) *Process Action Teams (PATs)*. Process Action Teams are short-term teams established to conduct specific process-improvements and establish stable processes based on those improvements. PATs are chartered by QMBs with direction from the ESC. The Process Action Team works closely with the QMB and must identify the causes of variation in the outcome, and establish clear data collection procedures. After

collection and analysis of data, the PAT can remove or make recommendations to remove special causes of variation, and report common causes of variation to the QMB. Finally, the PAT must be given authority to act upon causes that are "local" to the process. [Ref. 12:p. 3-9]

(4) *TQL team linking pin.* Downward link-is a member from the ESC when linking down to a QMB, or a member of a QMB when linking down to a lower-level QMB or a PAT. The member selected for this role should have some knowledge of the particular part of the process under study by the lower-level team. If for example a QMB charts two PAT teams, then each of these teams would have its own downward link from the QMB team to help them. The roles and tasks for the linking pin are: courier of the charter, interpreter of limits of responsibility, messenger of common causes, provider of resources, and identifier and remover of impediments [Ref 1:p. 2-44]. Upward link- The PAT or QMB team leader serve as the upward link to the next higher-level team. Their primary responsibility is to reporting results of processes improvements to the higher-level team. [Ref. 1:p. 2-46]

(5) *TQL Supporting Roles.* Besides the teams, the organization needs a few other people to support TQL. The organization implementing total quality will need a TQL coordinator and some quality advisors, as well as a

professional statistician. The roles of these people are briefly presented as follows;

- **TQL leader**-This is normally the commanding officer or officer in charge. He is responsible for TQL implementation and strategic improvement in the organization by establishing the critical mass. leading efforts to formulate a strategic plan, ensuring the deployment and implementation of the strategic plan throughout the organization, and evaluating progress on strategic improvement efforts. The TQL leader normally serves as the chair of the ESC.
- **TQL coordinator**-reports directly to the organization's leader. His responsibility is to advise, consult, and assist the TQL leader and the ESC in planning for and improving performance in the organization.
- **Quality advisor**-His primary duties are to advice, assist facilitate, and train members of teams involved in process improvement. He also assists the TQL coordinator in assessing team training needs and documenting lessons learned; as well as, maintaining a library of improvement team case studies.
- **Statistician**-may be required to test the design to improve the process further [Ref. 12:p. 2-49].

d. Strategic Focus

The DON's approach to TQL implementation requires a strategic plan which includes actions required to achieve TQL transformation. Key to the success of implementing TQL is the commitment of the top leadership to the long-term goals - continuous improvement of the system of production and service. A major problem that the American and Greek Navies are facing today is the relatively short term of the

commander's tour of duty - typically between 18 months to three years. To assist Navy organizations and operating forces in addressing this and other problems, the Navy Personnel Research and Development Center (NPRDC) has developed a "two-phase approach" to implementing TQL.

(1) Phase I: Establishing the "Critical Mass".

During phase I, the primary objective for a command is to create a critical mass of leaders who understand, accept, and practice the principles of TQL. Achieving critical mass is accomplished by education and planning. Education consists of at least 80 hours of education and training in critical elements of TQL, such as; recognizing the differences between inspection and prevention, leadership responsibilities, system optimization, developing a quality philosophy, strategic planning, statistical thinking, differences between "special and common causes," relationships between customers and suppliers, and other critical elements previously mentioned through Deming's philosophy. The planning should emphasize; customer-defined requirements, continuous improvement of quality, a structured approach to process analysis and improvement, data-based decision making, and evaluation of outputs in terms of customer requirements and future needs.

During this phase, as a part of top managers training, some "pilot projects" can be conducted to help them in learning the process improvement. These pilot projects are

an integral part of the implementation strategy and are accomplished by delegating these tasks to such teams as the QMB and PAT. Moreover, if the projects that are undertaken have strategic focus (important to organization's mission), it is conceivable that the effect of the chain-reaction could result in achieving goals such as: identification, measurement, and improvement of all significant processes [Ref. 18:p. 3-4].

(2) *Phase II: Organizational Transformation.* Phase (I) focuses on activities with near-term improvements of selected processes while Phase II activities address long-term issues. During Phase II, activities result in innovation and design of new systems or processes aimed at the strategic business processes of the future. The key to success in implementing TQL, is for the leadership to adopt a strategic change management process which focuses on satisfaction of external customers needs, achieving the planned strategy of the organization and defining the critical processes. On the other hand, programs aimed at raising certain productivity and quality measures in the short-term instead of the long-term plan will be just another short-term remedy that will fall short of solving the long-term problems. [Ref. 18:p. 5-6]

III. METHODOLOGY

This chapter describes the survey technique, structure of analysis, and statistical method used in this thesis.

A. RESEARCH DESIGN

This thesis assesses the implementation of TQL on the U.S. Navy operating forces and examines the potential for application of TQL in the Hellenic Navy. To accomplish this, a valid survey was developed to examine the implementation in the U.S. Navy operating forces. Then results were analyzed to determine the applicability of TQL in the Hellenic Navy. The survey addressed the process of implementation of TQL on ships and other operating forces by questioning, primarily, the top management of selective operating forces. In addition, climate survey questionnaires were randomly distributed among ships' crews and used to assess their understanding of TQL. Climate survey questions were based on generally accepted Total Quality assessment criteria. The returned survey questionnaires were subjected to statistical analysis based on the SPSS and SAS statistical program, to determine which points from Deming's "14 Points of Management," were adopted and effectively achieved within the commands.

1. Survey Techniques

The researcher opted to use both qualitative interviews and a quantitative questionnaire. Appendix B contains the interview questions which were developed and used to obtain responses from both the CINCPACFLT Total Quality Leadership Team in San Diego. Appendix A contains the interview questions which were used to obtain responses from the Top management of selected operating forces, as well as the climate survey questionnaire that was given to ship-crew members. The questionnaire is based on Dr. Deming's "14 Points of Management," and is intended to document how effectively each point is being accomplished among the crews.

a. Interview questions

The researcher selected the interview questions which met the criteria of being: (1) open-ended in nature and (2) reflective of the primary and secondary thesis questions (previously listed in Section C, Chapter I).

Appendices A and B contain a list of the interview questions for the top management of ships and aviation and helicopter squadrons, and questions for the CINCPACFLT TQL Team, respectively. Before closing the interview, the researcher invited interviewees to participate in a free-flowing discussion where the respondent could make specific comments concerning their thoughts, perceptions or concerns about TQL. The CINCPACFLT TQL team interviews were conducted

one-on-one with the five members of the TQL Team. In the aviation squadron only the CO was interviewed, but the researcher also had the opportunity to attend an ESC meeting where the squadron's vision was being revised. In the helicopter squadron, both the CO and the TQL coordinator were interviewed, while one department head and the command master chief agreed to provide written responses by mail. Prior to the start of the personal interviews, each interviewee was given a brief overview of the researcher's scope and was told of the researcher's commitment to the confidentiality and anonymity of all responses.

Since, due to operational and time constraints, interviews with personnel onboard ships could not be conducted in person, the climate survey questionnaires and the personal interview questions were mailed to TQL coordinators onboard ships. They administered the survey/personal interview questions and returned the completed material to the researcher. The researcher also sent a cover letter to the ships' TQL coordinators with instructions for the proper conduct of the survey, and reassured them about the confidentiality and anonymity of the responses. Interviewees onboard the ships included; CO, XO, one department head, the TQL coordinator and the command master chief. Moreover, twenty climate survey questionnaires per ship were sent to the TQL coordinators to conduct the survey of the crew and return the

responses. The same cover letter included instructions for the climate survey questionnaires.

b. Climate survey questionnaire

The climate survey questionnaire contained seventy-seven questions related to Deming's 14 points and were arranged in such a way so that those answering the questionnaire did not know which question dealt with which of Deming's points. This was done to reduce bias and insure more truthful responses. The questionnaire also included four additional questions dealing with demographic factors such as: rank, length of service onboard the ship or command, service as a team-member of PAT-ESC-QMB, and degree of knowledge about TQL from the Navy's TQL courses. The respondents to the questionnaire had to answer each question from among the following responses: Strongly Agree, Agree, Undecided, Disagree, Strongly Disagree, and Not Applicable/Don't Understand. The responses were entered into the statistical program SPSS.

B. STRUCTURE OF THE ANALYSIS

1. Sample size

The in-person interviews were conducted with the five members of the CINCPACFLT TQL Team, an aviation and helicopter squadron CO, and the TQL coordinator of the aviation squadron. Moreover, two department heads and the command master chief from the helicopter squadron provided written responses in

lieu of personal interviews. From five ships contacted, three responded as follows: the CO of the first ship; one department head, TQL coordinator, the command master chief, and nineteen of twenty climate survey questionnaires from the second ship; and the CO, XO, one department head, command master chief and twenty climate survey questionnaires from the third ship.

Table I
USN Operating Forces, responses in survey

	<u>CO</u>	<u>XO</u>	<u>DH</u>	<u>TQLC</u>	<u>CMC</u>	<u>CLIMATE SURVEY</u>
AV.SQD	X					
HL.SQD	X		X	X	X	
SHIP 1	X					
SHIP 2			X	X	X	19
SHIP 3	X	X	X	X	X	20
SHIP 4			NO RESPONSES			
SHIP 5			NO RESPONSES			

2. Demographics

The subjects of the interviews were the top management of the commands, because they have the most knowledge and understanding of TQL and the process of its implementation in

their units. The interviews with the CINCPACFLT TQL team members are of significant importance because these members serve in a key role as the "external facilitator." The questionnaires were sent to the TQL coordinators for each ship. Each TQL coordinator was selected to facilitate the conduct of the climate survey and the interview questions because they were trained in Total Quality Leadership and their positions allowed them to randomly select among the target audience (educated in TQL) to complete the climate survey questionnaire.

All the participating commands had been exposed to TQL for approximately two years, so there was no significant variance in their experience that could affect their responses.

The statistical analysis of this thesis was conducted with the two ships which returned the completed climate survey questionnaires. The ships' responses were examined separately (to see if there was significant differences to avoid improper results) and together as one entity. Four demographic factors were used; interviewees rank, length of service at their command, participation in any TQL team, and degree of knowledge about TQL. All the 39 questionnaires received were included in the statistical analysis.

The range of TQL exposure time for both the aviation and helicopter squadrons was approximately two years. The

exposure time for all the ships was eighteen months to two years.

3. Assumptions

The potential for bias on the part of the climate survey questionnaire was a known problem for the researcher, particularly under the conditions of downsizing in the U.S. military forces. For this reason, the cover letter attached to the survey emphasized the confidentiality of the participants and their responses - in the hope of reducing bias (see letter in Appendix A).

For a better evaluation on the chapter concerning the Hellenic Navy approach, the researcher distributed the climate survey questionnaire to the Greek officers who were students at the Naval Postgraduate School at the time. This approach was used to examine how far the opinions of Greek officers, who had no idea about the TQL, were from Deming's philosophy. The statistical program SPSS was also used to interpret the responses of the 24 Greek officers.

4. Drawing conclusions from the data

The interview questions were arranged into two different categories in such a way to determine how TQL is implemented on the selected operating forces, and how the CINCPACFLT Team contributed in this endeavor. In addition, statistical analysis was used to assess the comprehension of the TQL philosophy by the mid-level managers, and its

applicability onboard ships. In order to assess the implementation of TQL, the following questions were solicited from each category of interviewees:

a. TQL Team

- Contribution in the implementation of TQL onboard the ships
- Major problems faced during the implementation
- Lessons learned from the implementation
- The time-table followed in the implementation of the TQL
- How fear among the sailors is dealt with by the leadership
- What indicators does the U.S. Navy experience give about the applicability of TQL on the Hellenic Navy

b. Operating Forces Top Management

- Defining and satisfying the customer needs
- What specific improvements by area have been affected from the implementation of TQL
- The chartering of the TQL Teams
- Level of performance before implementing TQL
- Plans to assess the workability of the change to TQL
- Acceptance of TQL among the crew
- Impact of TQL on the chain of command, the discipline and morale onboard, as well as, the fitrep/evaluation system and the rotation system
- Impact on operational readiness of the ship
- Major problems faced from the implementation of TQL

c. Climate survey questionnaire

The climate survey questionnaire was used to obtain the opinions of randomly selected crew members, onboard the ship, based on seventy-seven questions which were grouped by the researcher to correspond with each of Deming's fourteen points. Specifically, the researcher tried to determine how people understand TQL, how they act under TQL, and what the role of Leadership is in the new philosophy.

C. TESTING PROCEDURES

This thesis used two ways to assess the implementation of TQL on U.S. Navy ships. Personal interviews with the top management and climate survey questionnaires among the crew members were used to examine the understanding and acceptance of TQL in the operating forces.

The assumptions of this research were compared with the conclusions arrived from the responses from the U.S. Navy ships, each ship individually, and all-together as one entity. The respondents were asked to answer each question from among the following choices; strongly agree, agree, undecided, disagree, strongly disagree, and not applicable/not understand, on a numeric scale from 0 to 5. Running the responses through the statistical program SPSS and SAS for each of Deming's points, obtained statistical mean values and standard deviations. Mean values greater than 3.0 indicated that that point of Deming; (a) in the U.S. Navy had been

adequately adopted and was functioning and (b) in the Hellenic Navy indicated relative positive proximity. Mean values less than 3.0 indicated that that point of Deming; (a) in the U.S. Navy had not been adopted yet and (b) in the Hellenic Navy there were difficulties expected in the implementation.

The application of TQL was measured in two dimensions: the finding of mean value, the standard deviation, and the level of significance from each of Deming's points; and the examination in the various ways of the interrelation of the four demographic factors with the Deming points.

For the survey questionnaire, administered to the Greek officers, mean values and standard deviations also were used to examined how far away the Hellenic Navy is from Deming's philosophy.

IV. SURVEY RESULTS

This chapter presents the results obtained from the conducted surveys. The first section presents the responses and estimation from CINCPACFLT TQL supporting Team in San Diego, the second section presents the views of operating forces personnel and particularly the responses of Top Management, and the third section walks through the climate survey in order to clarify if people understand TQL and how the 14 points are working.

A. CINCPACFLT TQL TEAM RESPONSES

The CINCPACFLT TQL Team is located in San Diego at the Navy Training Center, and consists of people who specialize in TQL and serve a significant role by helping the ships from the view of the external facilitator. The following are the questions and their responses.

1. Contribution in implementing TQL

How do you contribute in the implementation of TQL on ships?

Most feel that their main role is to provide consulting services to various commands which implement TQL and includes:

- Assist in the facilitation of strategic teams.

- Help the commanders and TQL coordinators develop implementation and TQL training plans.
- Provide lessons-learned.
- Provide five day middle managers TQL overview.

Furthermore, the TQL team works closely with various commands, at their request, to support their transformation to quality. The team contributes as a facilitator by giving an outside perspective. Provides ideas, tools and suggestions, and even participates in Executive Steering Committee (ESC) meetings to help implement their plans. The team's mission is to bring the academic philosophy in practice.

2. Measuring success of TQL implementation

How do you plan to determine how well TQL is implemented?

They continuously evaluate the implementation process and make assessments based on climate surveys to determine how well the implementation is progressing. The team work with the CO, TQL coordinator and the other members of the ESC, to review the process improvements and suggest action to be taken. Based on observations of vertical and horizontal processes, this team supports and provides recommendations on critical processes to allow cross-functional teams to work together. The team spends approximately one year in evaluation of the acceptance of TQL of each command. The assessment of the success of TQL is based on the improvement of operational readiness and the ability of the ship to accomplish the

mission while staying within the restrictions of its budget. Since TQL implementation requires several years to complete, its success cannot become apparent in the short-term.

3. Organizing the teams

How did you organize the teams on the ships? Do the commands organize their own teams?

The CINCPACFLT TQL Team does not organize the implementation teams. It only makes recommendations to commands to establish a permanent ESC consisting of CO, XO, Department heads and Command Master Chief. The ESC in turn, organizes the teams as needed to implement TQL onboard the ship. The command charters QMBs (made up of process owners) and PATs (sailors in the process). The last two teams should be used to work on cultural strategic (long-term) processes. The normal chain of command should use TQL tools to improve day to day routine processes.

4. Major problems

What major problems did you face and in what areas within the ship upon the implementation of TQL?

Some senior members involved in the implementation of TQL were not fully committed to the project and therefore hampered the process and the chance of success. There were problems of cooperation between departments to work horizontally. There was a reluctance by members of the senior leadership to take risks by making changes, because they did

not have immediate indicators that the new philosophy is working. At times there was confusion among the crew as to what was required from them under the new philosophy.

5. Lessons learned from implementing TQL

What mistakes could be avoided when starting another implementation of TQL?

The key to the successful implementation of TQL, as with any long-term process, is to fully educate everyone who will be involved in the process. Specifically, the leadership must understand the overall plan and be fully committed for the entire duration. There must be a long-term strategic plan that scopes the entire project and has the total commitment and support of the senior leadership. At the same time, the chain of command must work to improve the quality of daily activities, which improve the quality of life of the ship. Divisions' chain of command must evaluate and assess the daily progress in order to have confidence that the process is working. There must be positive incentives for those that take the risk of implementing TQL.

6. Steps for implementing TQL

What general steps should be followed from the beginning to implement the TQL philosophy on a ship?

The top management of the command must attend the seminar for senior leaders and become fully trained about the new philosophy and what is involved. Identify and fully train

the appropriate people to serve as TQL coordinator and TQL advisors. Educate the crew, starting from the critical mass and expanded later to the rest of the crew.

During the first year of implementation, begin a pilot process to give top management practical experience for improving the process. In the next step, those senior leaders who are educated must identify the main processes, the customers, the mission and vision to lead the organization to the transformation.

7. Impact of TQL on the chain of command

How has TQL effected the proper functioning of the chain of Command on the ship?Does everybody understand who is the boss and who is the worker?

TQL has not had an adverse impact on the chain of command. In fact, it has strengthened its effectiveness. The vertical communication is intact, while the parallel communication is enhanced. Only those who misunderstand or are opposed to TQL, can make the claim that TQL affects the chain of command.

8. Driving out fear

How does the leadership ensure that sailors do not fear speaking out?

Good leadership requires those in positions of authority to insure that their subordinates feel comfortable in voicing their recommendations for improvement without fear

of punishment. The leadership is responsible for creating an atmosphere of open and free exchange of recommendations and discussion.

9. Applicability to the Hellenic Navy

What do you think the experiences on U.S. Navy ships tell us about the applicability of TQL to another Navy (Hellenic Navy)?

Many respondents are of the opinion that TQL can be applied to any navy and to any organization. For the Greek Navy, many feel that it would be quite easy to implement TQL, although some cultural training will probably be required. They feel that, like in the U.S. Navy, at first there will be some resistance encountered from the senior leadership. If TQL proves successful in the Hellenic Navy, some feel that it can be applied in the civilian sector of the country with great success.

B. OPERATING FORCES TOP MANAGEMENT RESPONSES

Following are the responses of the top management of the operating forces. Only three of the five ships contacted chose to participate in the survey. Up to the completion of this thesis the two other ships, verified that they received the survey, but did not give any explanation about their failure to participate in this effort. From those who responded, only ten of the fifteen questionnaires were received. Furthermore, an aviation squadron and a helicopter squadron, although not

initially included in the plan, willingly provided five responses. Given ship deployments and other priorities among those that were solicited, the responses received were better than anticipated.

1. Defining the customer and his needs

How did you determine who your customers are? How did you initially determined your customer needs or requirements? How do you ensure you continue to update your customers needs?

The ESC initially determines who its customers are by conducting several brainstorming sessions. A master customer list is developed and subsequently broken down by department. The next step identifies the customer's needs/requirements, which is accomplished by way of surveys and personal interviews. As a result of data collected, the ESC will eventually narrow down to the most significant customers. The Command must ensure that its customers needs are current by re-visiting their needs/wants on an annual basis. Through the responses it is also apparent that the commands have chosen to focus on informal processes. One respondent was obviously only focusing at the internal customers, and not the external customers, when he responded that the customers for his ship are themselves.

2. Areas improved

What have you improved using TOL?

The respondents indicated that several improvements have occurred that can be attributed to the TOL implementation, but all the improvements are in informal processes which were not included in the long-range plan. These improvement are as follows;

- Engineering tool management
- Message release control
- Deck department space rehabilitation
- Ammunition transaction reports
- Small arms qualifications
- Submarine Weapons loading
- Awards process
- 3M spot check program
- In-rate training
- Watchstanding
- Reenlistments
- Morale
- Formal education for sailors
- Engineering preservation
- Command recreation support

3. Organizing the Teams

How did you organize the team(s) to improve each process/area and who was on it?

The ESC was made up of the senior leadership, as outlined earlier. It utilizes the same method for studying any process they feel requires improvement. A brainstorming session is conducted by all members in order to identify which individuals within the command are involved or responsible for the area being studied. It is then decided whether a QMB/PAT must be chartered, or if the process can be studied on an individual basis. The appropriate decision is then taken and the team/individual periodically reports back to the ESC on any progress. The following are the teams chartered by the ESC with the membership of each.

Quality Management Board (QMB) consisted of department heads and division officers. Based on the situation, it could also include command master chief, and petty officers.

Process Action Teams (PAT) consisted of cross-departmental representatives and sailors involved in the process.

4. Level of performance before TQL

What was the level of performance before you started the improvement work?

The level of performance in each area prior to being studied was adequate at best. Each process was functioning

sufficiently enough to allow the command to perform its daily routines and missions. However, it was discovered that these areas were not as efficient as was desired.

5. Measuring the success of TQL

How do you plan to determine how well the changes are working?

Through statistical process control to determine trends of improvement. Additionally, climate surveys in each department will be conducted at regular intervals to determine trends of positive or negative change.

6. Acceptance of the crew-members

What is your assessment of the acceptance of TQL by the crew? Are there any differences among various groups of personnel?

TQL seems to have general acceptance by the majority of those involved in the process of implementation, and especially by the junior and lower grades. There is a tendency on the part of those members who have extended time in service, both senior officers and petty officers, to resist change. Resistance comes mostly from those whose perception is that TQL is a maximum effort and time investment for minimum gains. One respondent made the following break-down of acceptance by categories;

- Junior personnel - great level of acceptance, gives them an outlet to express their ideas and have a direct impact and contribution.

- Supervisors - medium level of acceptance, sometimes resist input and recommendations from juniors.
- Senior managers - medium level of acceptance, want to streamline the process to get good results in less time, they feel that they will never have time to manage a full formal TQL program.

One respondent said that the TQL is a matter of interest only for the seniors and supervisors - the lower enlisted have no need to know.

7. Impact on Preventive Maintenance System (PMS)

Have you targeted the PMS for improvement? If so how?

None of the commands has directly targeted PMS for improvement. However, two have chartered Quality Management Boards (QMBs) which have targeted the maintenance process for study, in which PMS may become a part. One interviewee said that his command did not target PMS for improvement because "the PMS system in the Navy has an effective feedback program for constantly improving equipment maintenance."

8. Impact of TQL on the Chain of Command

Has TQL affected the proper functioning of the chain of Command on the ship? If so how?

Fundamentally there has been no affect on the chain of command as a result of TQL. However, functionally TQL has allowed the sailors of the ship to communicate and cooperate more effectively horizontally without violating the vertical structure of the chain of command. The big trick here is that TQL facilitates cross functional communication and drastically

improves the profound knowledge of shipboard operations. Recommendations from PATs and QMBs are reported hierarchically from linking pins to department heads and from them to CO and XO which maintains the vertical chain of command.

9. Impact on Discipline and Morale

How did TQL affect the discipline and the morale onboard?

TQL has not had any substantial effect on discipline within the commands. However, some feel that it has improved morale. Even though there seems to be no effect on discipline, the morale appears to be much better because of improved communications among the departments.

One XO responded that TQL has had no impact on morale and discipline because he emphasized that morale and discipline have a higher priority than TQL onboard his ship. He believes that good leadership is the key to good morale and discipline, with or without TQL.

10. Impact of TQL on Operational Readiness

Has TQL improved the operational readiness of your ship (squadron)? If so how?

Generally there is agreement that operational readiness in the commands has improved since the introduction of TQL, but it is uncertain to what extent this improvement can be attributed to TQL. However, TQL has directly improved

communications within and between Departments which might be a major factor contributing to Operational Readiness.

One respondent who believes that TQL has had no impact in the operational readiness of his ship stated that even Deming would agree that TQL is an inappropriate application for ships. He considers TQL to be a waste of time for a tactical environment at sea. He thinks that TQL has better applicability for on shore establishments.

11. Effect of TQL on appraisal system

How has your involvement in TQL affected your fitrep/evaluation?

Fitrep/Evaluations have not been substantially influenced by involvement in TQL. A more accurate statement is to say that no individual has been hurt by involvement in TQL.

12. Major problems-Lessons learned

What major problems did you face, and in which areas within the ship (squadron) did the problems occur while implementing TQL?

The Commanding Officer of a Helo squadron addressed several lessons-learned and accomplishments achieved during two years of TQL implementation in his Command. He stresses:

First, the value of continuous training in the principles of Total Quality cannot be overstated. We have learned through experience that prior to implementing Total Quality, a command must ensure that all key players (i.e. TQL coordinators, advisors, ESC members, and QMB team leaders) have had sufficient training. Attempting to initiate a program based primarily on the strength of the

"Fundamentals of TQL" class invites frustration, duplication of effort and wasted time. Second, the results attained by QMB's and PAT's must be widely publicized. This may be accomplished through POD notes, presentations at quarters, or any other means available. The value of picking the "Low Hanging Fruit" aids in acceptance of TQL by members of the command. Although it is a long term process, the sooner individuals see that TQL is beneficial to them, the easier they will accept it.

Third, forming several QMB's during the initial phases of the program can be detrimental. It puts pressure on to succeed in several areas at once through a program that no one has had any previous experience implementing before. By forming only one or two QMB's initially, you can learn from the mistakes made, and thus ease the transformation in the future with other QMB's.

Fourth, Total Quality stresses the collection of data in order to produce measurable results. We have found this readily available in such areas as enlisted personnel readiness, training, and maintenance. However, in other areas this often leads to collecting data in order to have something to measure, whether it is relevant or not. Not all results achieved by QMB's have been quantifiable.

Finally, the role of TQL coordinator or advisor has become a primary duty as opposed to a collateral one. Personnel chosen for these position should not be assigned many other time consuming duties. A successful program will require a substantial investment of time by these individuals.

One respondent said that in his command they have made all the classical mistakes, including attempting statistical control without proper training by the ESC and QMB members.

Another respondent felt the only problem encountered was that a few members of the crew thought that TQL meant a chief or officer was never allowed to yell at them. This came into play a couple of times. Sometimes it was necessary to yell at some hard-headed individual to get the point across. This was the only major headache.

A third respondent said that TQL is best suited for industrial and administrative processes, but has little or no effect in a tactical training or operational arena.

Many respondents stressed that there was no apparent support from the external chain of command because it has not yet embraced TQL.

13. Affection on personnel tour in the commands

How does the transfer of new crew members affect the application of TQL?

The incoming crew members usually have no knowledge of TQL and must be trained from the beginning. Those who depart, especially if they occupied a key position in the implementation of TQL, are a valuable asset for their new unit but cause a big disruption to their losing command. Once all commands have implemented TQL this problem will not be as significant. Even now despite the disruption caused by transfers the process continues according to plan.

14. Applicability to the Hellenic Navy

What do you think U.S. Navy ship experiences tell us about the applicability of TQL to another Navy (Greek Navy)?

The general opinion is that any traditional structured Navy will have initial problems accepting the entire TQL formula as presented in the US Navy. If sociological barriers to free communication are breached, TQL can work in any organization.

A respondent said, he hopes that TQL will work for the Hellenic Navy, but will require a top-down approach and ensure that all ESC and QMB members are fully trained prior to attempting implementation. With TQL, a little knowledge mixed with copious amounts of drive and motivation is a very dangerous thing indeed. TQL requires that leadership has the patience and good sense to listen to the deckplate level.

Another respondent believes that it would be too painful an experience for a small Navy like the Greek to undergo this change to TQL, especially when the expected results would at best be only marginal.

C. CLIMATE SURVEY RESPONSES

This part of the survey is made up of seventy-seven questions which are relevant to Deming's fourteen points. The analysis reveals the degree of understanding by mid-level management, and which of Deming's points have been embraced and adopted. The respondents were asked to answer each question from among the following choices; strongly agree, agree, undecided, disagree, strongly disagree, and not applicable/not understand.

The sample size consisted of thirty-nine members of two ships broken down into; 6 officers, 1 chief petty officer, 27 petty officers and 5 non-rated enlistees.

Four demographic factors were used in this survey; rank, possessed education of TQL, length of tour in the command and

participation in any TQL role. The education level of people surveyed varied and included the following courses; 1) TQL Orientation (briefed by senior leaders or supervisors), 2) Introduction to TQL (1-day), 3) Fundamentals of TQL (4-days), 4) Implementation of TQL, 5) Systems Approach to Process Improvement (SAPI), 6) Team Skills and Concepts for TQL, 7) Methods for Managing Quality and 8) those who were self-taught.

When necessary, crosstables were used to combine selected responses with the corresponding demographic factors. The length of tour onboard the ship was not significant because all those surveyed had been onboard since the TQL implementation date or longer.

- **Point 1: Create constancy of purpose for improvement of product and service**

Statistics derived from each question give this point a mean value of 3.14, which implies that; leadership is starting to pay more attention to the long-range results, customers and their needs have been clarified, sailors have a more clear understanding of their

Table II
Statistical Values for Deming
Point 1, USN Operating Forces

QUE	MEAN	STD DEV
3	3.256	0.909
5	3.846	1.181
12	2.358	1.202
18	3.230	0.985
22	2.538	1.232
27	2.641	1.327
34	2.384	1.310
35	4.051	0.916
43	3.589	1.018
59	3.564	1.095
DEM 1	3.146	1.263

responsibilities and mission since the implementation of TQL, and they possess the knowledge of how their department's goals fit in the command's goals. On the other hand, the low mean value of some questions also indicate that the changes required for the constancy of purpose have not been fully realized. The survey shows that the leadership is not completely convinced that TQL is the only solution to achieve continuous quality improvement. Thus the subordinates tend to see TQL as the idea of the month.

- **Point 2: Adopt the new philosophy**

The statistical average mean value of 2.93 indicates that the surveyed people have not yet fully adopted TQL.

Specific questions indicate the areas where they agree with the new philosophy and where they have diverse opinions. The responses indicate that leadership treats those surveyed with dignity and respect, which implies that leadership considers them as the most important

Table III
Statistical values for Deming
Point 2, USN operating forces

QUE	MEAN	STD DEV
1	3.256	1.185
4	2.512	0.942
9	2.769	1.459
14	2.846	1.203
28	2.794	1.173
30	3.205	1.104
49	3.076	1.132
64	3.282	1.316
74	2.641	1.135
DEM 2	2.931	1.207

asset of the ship. They demonstrate that their ship seeks to learn its customers and what they expect. Although they consider TQL to be the idea of the month, they have no

difficulty relating to its concept. This is a positive indicator the TQL has a good chance for acceptance. On the other hand, because some sailors appear to accept the new philosophy while in reality resisting it, and the leadership, in order to achieve greater productivity still emphasizes quantity more than quality, the ship often fails to live up to its commitment to customer satisfaction. Thus the respondents believe that the future of the ship is uncertain while the new philosophy is being implemented. Given that TQL has not yet been fully implemented and it is a long-term process, the skepticism of the respondents is quite appropriate in this case.

- **Point 3: Cease dependence on mass inspection**

The low mean value of 2.58 indicates that inspections are still prevalent, and that TQL has not succeeded in reducing the need for

inspections. The sailors use inspection either for safety reasons, as a standard procedure, or to insure that quality products and services are being delivered to the customers. They consider it essential to inspect

Table IV
Statistical Values for Deming Point 3, USN operating forces

QUE	MEAN	STD DEV
16	2.461	1.334
39	2.589	1.140
45	2.410	1.163
56	2.871	1.321
DEM 3	2.583	1.244

incoming materials to have complete confidence that the

suppliers provide quality materials. Leadership, especially from higher headquarters, relies more on inspections and less on helping to improve the work process.

- **Point 4: End the practice of awarding business on price tag alone**

This point has a significantly low statistical score of 2.50 which implies that these ships still emphasize price more and quality less.

Those surveyed insure that their departments work closely with their suppliers to improve the quality of materials they use. However, due to institutional requirements they use more than one

Table V
Statistical Values for Deming
Point 4, USN Operating Forces

QUE	MEAN	STD DEV
24	3.051	1.074
65	2.358	1.087
75	2.102	1.447
DEM 4	2.504	1.270

supplier and cannot always be certain of the quality of his products. Furthermore, although leadership proclaims that its primary emphasis is on the quality of supplies, they still make purchasing decisions based on cost.

- **Point 5: Improve constantly and forever the system of production and service**

The statistical outcome of 3.12 demonstrates that people actively try to improve their work. They understand that statistical-process control has essentially helped them to continuously improve quality and to diminish the waste of materials and supplies in their departments.

On the other hand, they believe that if a greater emphasis is placed on statistical process control it could lead to waste of time and money.

Moreover, they point out that albeit leadership has adequate understanding of statistical methods for improving work process, it is not actively involved in helping them stabilize and improve the work process.

• **Point 6: Institute training**

The statistical mean value of 2.91 indicates that training needs improvement, and must be revised by the leadership as needed to meet the never-ending training requirements of process improvement.

Those surveyed pointed out that training is done on a "hit" or "miss" basis. The training they receive is not adequate to keep them proficient with

Table VI
Statistical Values for Deming Point 5, USN Operating forces

QUE	MEAN	STD DEV
2	2.692	1.417
15	4.205	0.731
23	3.205	1.196
25	3.205	1.592
42	2.897	1.020
62	3.102	0.994
67	2.564	1.333
DEM 5	3.124	1.300

Table VII
Statistical Values for Deming Point 6, USN Operating Forces

QUE	MEAN	STD DEV
7	2.692	1.417
17	2.846	1.348
37	2.641	1.224
50	2.333	0.995
61	3.743	1.069
70	3.256	1.093
DEM 6	2.918	1.269

technological and organizational changes. The training for the newly assigned sailors is not appropriate and complete, and they learn their jobs either from other sailors or from unintelligent printed instructions. Furthermore, the new sailors do not understand what is expected of them, although they really want to learn more about how to improve the work process. The training department diligently tries to teach sailors the tools necessary for quality improvement.

• **Point 7: Institute leadership**

The mean value for this point is very close to the point of ambiguity at 3.07. Perhaps, this is because the dominant opinions of

proponents exceed the opponents by a very small

margin, and thus give the

appearance of a positive

result for leadership

behavior. The leadership

seems to be supportive and

understanding when people

have new responsibilities

and tasks to learn. It is

sensitive towards working

with sailors to get their participation in the quality

improvement effort. It has made remarkable efforts in

soliciting opinions and ideas from subordinates on work

Table VIII
Statistical Values for Deming
Point 7, USN Operating Forces

QUE	MEAN	STD DEV
11	3.076	1.222
13	3.102	1.119
19	2.871	1.260
36	3.205	1.151
46	3.076	1.132
48	3.051	1.122
53	3.487	1.315
63	3.025	1.063
71	2.615	1.041
73	3.282	1.503
DEM 7	3.079	1.206

matters, and follows through on the recommendations for process improvement that are submitted by improvement teams. The sailors believe that their supervisors lead by example.

However, even though all of these indicators make the leadership significantly more effective, the sailors believe that their leaders are afraid that they will lose control if they delegate more authority to their subordinates. Furthermore, the supervisors are not actively helping their subordinates to apply the training in their job.

- **Point 8: Drive out fear**

Although there was only one question relating to this point, it is apparent from the answers that the majority feel free to recommend improvements to their supervisors. The researcher went a step further and ascertained that five out of six officers (mean value of 3.60), eighteen of the twenty-seven petty officers (considered to be the most senior) and the chief petty officer (mean value of 3.71 for all 29 petty officers) answered that they did not fear making recommendations.

On the other hand, it is remarkable that the non-rated sailors (mean value of 2.80), the remaining nine petty officers, and a commissioned officer indicated that they do not feel comfortable in making recommendations. Thus, fear may be diminishing among the seniors, while it is still common among lower ranks.

- **Point 9: Break down barriers between staff areas**

The bureaucratic barriers still exist, according to the average low mean value of 2.72. These barriers result in the lack of good cooperation and communication and sharing of information among the departments. Leadership seems to reward individual but not team efforts. The difference in goals and the lack of teamwork enforces a strong sense of "us" vs "them" between departments. There are few work teams which include members from other departments, even when there is the need to solve a common problem.

Table IX
Statistical Values for Deming
Point 9, USN Operating Forces

QUE	MEAN	STD DEV
8	2.512	1.211
26	2.871	1.104
41	2.564	1.209
54	2.794	1.341
76	2.871	1.398
DEM 9	2.723	1.253

- **Point 10: Eliminate slogans, exhortations and targets for the workforce**

The average mean value of 2.57 in the responses implies that ships use posters or slogans to exhort their personnel to increase productivity.

Table X
Statistical Values for Deming
Point 10, USN Operating Forces

QUE	MEAN	STD DEV
44	2.230	1.037
52	3.256	1.271
66	2.230	1.062
DEM 10	2.572	1.219

The respondents generally agree that when the leadership sets targets, without providing them with appropriate tools and methods, they are forced to devise their own tools and methods, and thus work harder to solve their quality problems.

- **Point 11: Eliminate numerical quotas**

The responses and the average mean of 2.57 indicate that the leadership in these ships believe that subordinates need numerical goals in order to stay motivated and do a better job.

Table XI
Statistical Values for Deming
Point 11, USN Operating Forces

On the other hand, subordinates argue that because the work standards or quotas are arbitrary and or unreasonable, they cannot often achieve the

QUE	MEAN	STD DEV
10	2.487	1.166
33	2.974	1.135
58	2.051	0.944
69	2.794	1.151
DEM 11	2.576	1.147

expected goals and become frustrated and demoralized. Furthermore, they stress that the quotas create impediments to effective performance and make it difficult to achieve the standards that have been set.

- **Point 12: Remove barriers to pride of workmanship**

The total low mean value of 2.85, combined with the partial responses revealed that leadership creates barriers that cause apathy, frustration and estrangement instead of pride of workmanship among the sailors. The respondents

complained that they did not have ample opportunity to use initiative on their job, while the procedures in effect at their departments were not conducive to a superior performance. Sailors are often encouraged to compete with others in order to improve

productivity, but they are working without a clear definition of what constitutes improved quality in the work process and falsely believe that only with more time they can improve their performance.

However, they assert that the tools and the work

environment have enabled them to produce quality work, and feel confident that their work process produces excellent overall quality. For them the appraisal system rewards and promotes those who are truly deserving.

- **Point 13: Institute a vigorous program of education and retraining**

Based on the average mean value of 3.25, we conclude that the leadership supports the crew's desires to improve themselves through education, even if it does not relate directly to their current job. Moreover, leadership encourages

Table XII
Statistical Values for Deming
Point 12, USN Operating Forces

QUE	MEAN	STD DEV
6	2.897	1.313
20	2.153	1.203
21	3.256	1.117
31	2.974	1.202
32	2.974	1.135
40	2.769	1.180
47	2.282	1.024
51	2.564	1.020
60	3.025	1.245
68	3.692	0.950
DEM 12	2.858	1.209

and provides education and retraining necessary to meet the future needs of the ship, through long-term planing. The sailors feel that the ship, as an organization, is willing to invest in developing their potential to be the best sailors they can possibly be.

- **Point 14: Take action to accomplish the transformation**

Although the information available about the overall quality improvement activities of a ship are inadequate, the sailors trust their leadership in its attempts to change their old style of management and lead the way to accomplish the transformation.

Table XIII
Statistical Values for Deming Point 13, USN Operating Forces

QUE	MEAN	STD DEV
38	3.000	1.213
55	3.435	1.165
77	3.333	1.221
DEM 13	3.256	1.204

Table XIV
Statistical Values for Deming Point 14, USN Operating Forces

QUE	MEAN	STD DEV
57	3.384	0.989
72	2.820	1.315
DEM 14	3.102	1.190

V. APPROACH TO HELLENIC NAVY

This chapter introduces the Hellenic Navy structure and the unique characteristics in Greek culture and thinking that affects its perceptions of quality. It also describes the problems facing the Greek Navy and gives a non-crossectional but fairly characteristic view of the Greek Navy leadership's perception of quality, through the results of survey of Naval Postgraduate School Greek Naval Officers. It concludes with an analysis of the data obtained from the U.S. Navy ships and examines the applicability of TQL on the Greek Navy.

A. GREEK CULTURE

1. Traits and character of the Greeks

Hellas, the name we Greeks call our country, has been an independent sovereign state since 1821, when it declared its independence from Turkey and fought a nine year war of independence. Ancient Greece was not only the birthplace of democracy, but also the birth of the Western ideas, culture, science and artistic heritage. The modern Greeks maintain most of the characteristics and culture of their ancient ancestors and have been influenced by many other cultures that then have come into contact with throughout their long history. Many Greeks and foreigners have written about the strengths

and weaknesses of the Greeks. Most agree that the Greeks as a people are very ingenious and learn the most complex concepts without much difficulty. The Greeks, from ancient times, have shown that they are not easily satisfied with the status quo and always searching for ways to improve their situation, as is shown by their tendency to seek adventure and innovation. Their love for freedom for their family, country and faith has made them unrelenting fighters with a very strong instinct for survival against all odds.

At the same time, the Greeks have a strong ego which has served to promote individual genius and selfless heroism in battle, but has also been an occasional obstacle to teamwork and progress to an organization or even to the nation during peacetime. Greeks tend to be impatient for long-term plans and projects, preferring instead to have shorter-term plans that give quick results. This lack of patience has been a hinderance to implementing long-term strategies. Being strong willed individuals since ancient times, the Greeks often fought among themselves for control and leadership. From the naval battle of Salamis in 480 B.C. where the Greek leaders argued among themselves to see who would direct the battle, to the current struggle for power among the many political parties, the Greeks have maintained this love of being in charge. This trait sometimes has the effect of producing too many chiefs and few indians, as the Americans like to say. Along with the strong ego, the Greeks are very

proud of their own ability and achievements. They are reluctant to accept the ideas and achievements of others and often would change a project in-progress, even if it is correct, just because it is not their own [Ref. 19:p. 76]. That implies lack of constancy of purpose, and often results in wasted efforts and suboptimization of resources in an organization or even the country.

2. Culture of the Hellenic Navy

The Greek Navy has its own honorable place among the Greeks. It has a three-thousand year tradition of distinguished service in defense of freedom and the Greek fatherland. It has contributed greatly to the spreading of Greek culture throughout the Mediterranean countries, played a key role in the defense of the one-thousand year reign of the Byzantine Empire, maintained its viability even during the four-hundred year Ottoman occupation (by acting as militarized merchant fleet), provided valuable services to the Greek war of independence, and served gallantly in the defense of the country and the Western ideals in the two World Wars and the recent Gulf War. The Greek Navy stands out as the only one in the world never to have surrendered its flag to the enemy. A historian once remarked that if the Greek History requires hundreds of books to be written, half of them would be written about the Greek Navy. The Greek Navy has been a strong supporter of democratic rule in Greece and during both

dictatorships in the twentieth-century (in 1936 and 1967) it resisted actively. Today's Greek Navy is made up of a volunteer officers corps and draftee enlisted sailors. The naval officers are the most aristocratic among the officers of all the Greek military services. They are highly educated and have a strong sense of duty and tradition. The heavy burden of their glorious ancestors from Themistokles to Kanaris and Koundouriotis to Laskos are a constant reminder to all naval officers to achieve feats equal or greater than those before them.

To be selected for service in the Navy as a draftee is matter of pride and honor for all men and women of military age. Greek families take great pride in boasting that their son or daughter is serving in the Hellenic Navy. The Greek Navy is a highly disciplined authoritarian and bureaucratic organization with effective top-down hierarchical communication. Onboard ships, the commanding officer has broad authority and is affectionately referred to as "God." The competition among the officers is very keen and often leads to conflict, because it rewards individual effort and discourages team effort. There is a perception among the leadership that their subordinates have limited knowledge and skills and therefore the leaders take on a heavier load of tasks. On the other hand, albeit the subordinates are high skillful people, they are reluctant to bring forth recommendations for improvements and other matters because they fear punishment

and ridicule from their superiors. The subordinates, however, have great confidence and respect for their leaders.

B. PROBLEMS FACING THE GREEK NAVY

1. Threats and Opportunities in the Environment

a. The Threats

Throughout its long history, Greece has faced numerous and constant threats from a multitude of hostile forces, due primarily to its strategic location in the crossroads to Europe, Asia and Africa. The Hellenic Navy has been called upon to defend Greece's considerable coastline from the time of the Persians in the 5th Century B.C. to the recent threats of the Greek Islands in the Aegean and Cyprus.

The Turkish invasion in Cyprus in 1974, and its centuries old aggressive policy against Greece have made Turkey the number one threat to Greek sovereignty and interests today. Despite the fact that both countries are members of the North Atlantic Treaty Organization, there have been several instances in the last twenty-five years when the two countries have come close to war.

Since the end of the Cold War and the breakdown of Yugoslavia, the creation of new or realigned states created another serious problem for Greece, along its northern borders. Refugees from all of Greece's northern neighbors have flooded the country, while ancient ethnic issues have created territorial and other claims against Greece. Most serious of

these threats is that of the newly independent state of Skopjie which calls itself Macedonia and has territorial, cultural and historical claims against Greece and its historical heritage. This issue, along with Turkey's claim of muslim minorities in Greece and the friendly-to-Turkey states of Albania, Skopjie and Bulgaria make all of Greece's land borders hostile and dangerous.

Due to the low demographic indexes (the lowest among the western European countries), Greece is faced with increased difficulty in maintaining sufficient numbers of draftees in its Navy and the other armed forces. This implies that the country must either increase the length of service among the available members of the force or increase the qualitative capability of its dwindling forces.

b. The Opportunities

The alliance of Greece with the NATO countries and particularly the United States, gives Greece access to the most modern quality management models, such as TQL, which can greatly improve the performance of the Greek forces and the Navy.

As a result of the end of the Cold War, there is an abundance of high technology weapons systems to modernize and equip the Hellenic Navy. Greece is already equipped with such weapons of high technology and can utilize high quality processes for its military personnel to maximize performance.

National economic and budget constraints have placed increased pressure on the leadership of the armed forces and the Navy to shift emphasis from quantitative to qualitative methods to improve product and services.

2. Internal strengths and weaknesses

The Greek Navy as it currently operates, with its strong tradition and proven record for mission accomplishment, is a very effective and successful organization. However, there are some weaknesses and anticipated challenges which prevent its optimization.

a. Strengths

The highly educated officers and enlisted personnel, with college education, make up a significant asset for the Hellenic Navy.

Although the Hellenic Navy is an autocratic organization, the senior leadership treat their subordinates with dignity and respect.

The long maritime tradition of the Greek people make the Hellenic Navy a homogeneous and experienced organization.

Due to the relatively small size of the officers corps, Naval Officers have the opportunity to obtain jobs of great challenge and difficulty which increases leadership skills and experience.

The discipline and morale of the Greek Navy are of the highest priority, and this is a main reason why 30-40 year old ships perform better than in their earlier life.

To the Greeks, the Navy is not only a job and an adventure, it is their favorite hobby.

b. Weaknesses

The lack of a domestic military industry for the main weapons systems and vessels make Greece dependent on foreign suppliers. Greek Navy has more than one supplier and therefore is required to adopt training and supplies from many varied sources.

Emphasis on higher headquarters inspections cause disruption in the normal operations, and do not result in useful or constructive recommendations. These inspections promote fear among all the ranks within the Hellenic Navy and require dedication of considerable man-hours in preparation.

Highly traditional bureaucratic management causes diseases and obstacles, such as those referred to by Deming, i.e.; short-term thinking, merit rating, mobility of management, crisis management, dependence on tiger teams, finger-pointing and assessment of blame, and bypassing of the system.

C. SURVEY OF GREEK OFFICERS

The Researcher brainstormed the idea of using the survey climate questionnaire to obtain the responses from the Greek

officers attending at the Naval Postgraduate School. A total of twenty-four Greek officers agreed to willingly and without retribution provide responses for this study. Among these officers there were 6 LCDRs, 7 LTs., and 11 LTJGs. All of them were highly educated and with enough experience in the Greek Fleet to have served, either as Department heads, XO's and or COs. Their responses were evaluated using each of Deming's points and then analyzed statistically using the mean values and standard deviations. The results were combined with data from previous sections, which concerned culture and status quo of the Hellenic Navy. This survey indicates the relative proximity of Greek officers' responses to Deming's 14 Points of Management.

1. Climate Survey Results

- **Point 1: Create constancy of purpose for improvement of product and service**

As depicted in the table of statistics for Deming's Point 1, the average mean value of 3.21 indicates that Greek officers believe that constancy of purpose for improvement of product and service currently exists within the Greek Navy. They strongly believe that their leadership wants to pay attention to long-term results, but it cannot plan for the future due to perpetual changes in the environment (new ways of recruitment, purchase of new types of ships, and change in the defense doctrine), and they mostly deal with current

problems which require immediate solutions. Through their responses they showed that they knew and understood their mission, and believe that their leadership is committed to the accomplishment of the mission. They feel that they can readily adapt to the new changes in the mission and the environment. They are prepared to make the ultimate sacrifice for the successful fulfillment of their ship's goals.

Table XV
Statistical Values for Deming
Point 1, Greek Officers

	QUE	MEAN	STD DEV
	3	3.291	1.428
	5	3.458	1.413
	12	2.625	1.438
	18	4.083	1.017
	22	3.291	0.954
	27	3.375	1.134
	34	0.000	0.000
	35	4.333	0.701
	43	3.916	0.880
	59	3.750	1.224
	DEM 1	3.212	1.589

- **Point 2: Adopt the new philosophy**

Because the Greek officers are not familiar with TQL concepts, this point attempts to show how the Greek officers can react to a new philosophy management. Although the mean value of 2.12 does not give definite indicators about this point, since the Greek officers do not know this philosophy, several conclusions can be drawn.

Even without TQL, the officers believe that their leadership treats its members with dignity and respect and considers them as the most important asset of the ship. Based on the present performance of the Greek Navy, they have no

doubt about the future of their ships. The majority of those surveyed are convinced that given emphasis on quality, the Greek Navy will greatly enhance its performance. This point clearly shows, at least among those surveyed, that quality in productivity is desirable and of great interest to the Greek Navy.

Table XVI
Statistical Values for Deming
Point 2, Greek Officers

QUE	MEAN	STD DEV
1	3.458	1.284
4	0.000	0.000
9	2.500	1.142
14	2.041	1.756
28	3.625	1.013
30	3.291	1.573
49	0.166	0.816
64	1.916	1.742
74	2.083	1.248
DEM 2	2.120	1.771

• **Point 3: Cease dependence on mass inspection**

It is apparent from the responses that everything in the Hellenic Navy depends on inspection as the statistical mean value of 1.9 indicates. As a military organization, the Greek Navy fully supports the need for inspection and considers it an integral part of daily routine. The officers declared that they believe in the inspection of both the incoming and outgoing products and or services.

Table XVII
Statistical Values for Deming
Point 3, Greek Officers

QUE	MEAN	STD DEV
16	1.583	1.212
39	1.541	0.977
45	2.208	1.473
56	2.583	1.212
DEM 3	1.979	1.289

They stressed that inspection is necessary because the leadership is of the opinion that their subordinates do not possess adequate knowledge of the process and therefore it is up to them to inspect in order to assure quality. They made a common comment concerning high authorities need to conduct inspections. More specifically they indicated. "The apprehension and fear inspectees experience causes them to focus on short-term fixes and doing what is necessary to pass the inspection and eliminate punishment."

- **Point 4: End the practice of awarding business on price tag alone**

With an average mean value of 1.97 this point shows that while the leadership is interested in quality, the ultimate determinant of the purchase is most often the cost. Those surveyed believe that the emphasis should be on quality, but have no hope that the current practice will change any time soon. They added

examples where purchases were made of very inferior products that were quickly useless just because they were the cheapest. This phenomenon has resulted due to very tight budgets, not only in the Navy but among all of the armed forces.

Table XVIII
Statistical Values for Deming
Point 4, Greek Officers

QUE	MEAN	STD DEV
24	2.041	1.899
65	1.583	1.100
75	2.291	1.334
DEM 4	1.972	1.491

- **Point 5: Improve constantly and forever the system of production and service**

The mean value of 2.15 shows that regarding this point there is a relative weakness in the Greek Navy. Those surveyed believe that there is a

Table XIX Statistical Values for Deming Point 5, Greek Officers			
	QUE	MEAN	STD DEV
continuous effort to	2	0.000	0.000
improve the work but they	15	4.375	0.577
are plagued with waste of	23	2.416	1.471
materials and supplies.	25	2.500	1.383
They are convinced that	42	3.333	1.090
statistical process	62	2.250	1.188
control is a unique way	67	0.208	1.020
for quality improvement	DEM 5	2.154	1.804
and elimination of waste.			

While efforts to improve the system through statistical methods have been attempted in the past, they have not produced the desired results due to bureaucratic red tape and lack of appreciation of the method.

- **Point 6: Institute training**

The average mean value for this point is 2.80, which indicates low success in the area of training. Those surveyed believe that the training was conducted based on immediate needs, without a long-term plan. This is due to continuous introduction of new systems. Due to various reasons, most personnel, especially the new draftees, receive on-the-job

training. However, the majority of the training conducted is up-to-date with the technological advances of the systems. There is a strong demand for training among the overwhelming majority of the naval personnel, as is

Table XX
Statistical Values for Deming
Point 6, Greek Officers

QUE	MEAN	STD DEV
7	2.541	1.768
17	3.416	1.282
37	2.500	1.179
50	2.000	0.780
61	4.208	0.832
70	2.166	1.307
DEM 6	2.805	1.440

apparent from the large participation of Greek Officers in the training opportunities offered in U.S. military institutions, like the Naval Postgraduate School.

• **Point 7: institute leadership**

The average mean value for this point is 3.15. This shows that leadership works closely with the subordinates in understanding how quality and productivity are related. The supervisors are actively involved in on-the-job training. Leaders set the good example for their subordinates to follow.

Table XXI
Statistical Values for Deming
Point 7, Greek Officers

QUE	MEAN	STD DEV
11	3.375	1.438
13	2.916	1.442
19	3.083	0.974
36	3.625	0.969
46	2.541	1.473
48	2.666	1.606
53	3.375	1.013
63	3.250	1.594
71	3.125	1.329
73	3.583	0.928
DEM 7	3.154	1.324

Due to the leaders higher educational level and professionalism, there is no fear that loss of control due to delegation of authority and responsibilities to subordinates. The supervisors have a comprehensive understanding of their subordinates jobs.

On the other hand, while leadership is dependent on subordinate participation in the quality improvement effort, it is not interested in the opinions of subordinates, nor do they easily accept opinions and recommendations from improvement teams.

- **Point 8: Drive out fear**

The average mean value of 3.62 indicates that the officers feel free to submit recommendations to their superiors, particularly when they hold key roles onboard a ship. On the other hand, it is the researcher's personal opinion that the lower ranks are reluctant to make recommendations because they fear punishment and ridicule. The only question asked in this point resulted in limited conclusions.

- **Point 9: Break down barriers between staff areas**

There is good cooperation and communication between departments, according to the average mean value of 3.11. Information is adequately shared, and cooperation is emphasized between departments. The leadership rewards both team and individual efforts. Despite the apparent cooperation, due to internal competition among the departments, there still

Table XXII
Statistical Values for Deming Point 9, Greek Officers

QUE	MEAN	STD DEV
8	3.083	1.212
26	3.416	1.138
41	3.166	1.049
54	2.416	0.880
76	3.500	1.318
DEM 9	3.116	1.175

exists a strong sense of "us" vs "them." When problems arise that affect the entire ship, work teams that include members from various departments unite to solve the problem.

- **Point 10: Eliminate slogans, exhortations and targets for workforce**

The average mean value of 2.58 indicates that leadership relies on slogans, exhortations and sets targets for the subordinates to achieve common goals without providing the appropriate methods and resources.

Table XXIII
Statistical Values for Deming Point 10, Greek Officers

QUE	MEAN	STD DEV
44	2.333	0.868
52	2.750	1.359
66	2.666	1.403
DEM 10	2.583	1.230

The surveyed officers believe that under this approach subordinates are forced to work harder to meet the targets set by the leadership.

- **Point 11: Eliminate numerical quotas**

The average mean value of 2.72 indicates that leadership seems to believe that sailors need numerical goals to stay motivated. It is the opinion of those surveyed that the work standards and quotas are arbitrary and unreasonable, thus

Table XXIV
Statistical Values for Deming
Point 11, Greek officers

QUE	MEAN	STD DEV
10	2.166	1.464
33	3.250	1.259
58	2.583	1.138
69	2.916	1.384
DEM 11	2.729	1.349

making it difficult for the subordinates to produce good work.

- **Point 12: Remove barriers to pride of workmanship**

The average mean value of 2.78 shows that those surveyed are split in their opinions that there is ample opportunity for subordinates to use their full abilities in their job. For the officers, they feel that there is a constant heavy overload of tasks which causes frustration and prevent the realization of their full potential. This type

Table XXV
Statistical Values for Deming
Point 12, Greek officers

QUE	MEAN	STD DEV
6	3.000	1.141
20	2.958	1.267
21	2.416	1.248
31	2.875	1.423
32	2.875	1.295
40	2.250	0.896
47	2.166	1.049
51	3.041	1.366
60	2.708	1.301
68	3.541	0.832
DEM 12	2.783	1.265

of environment favors those who only react to the immediate tasks required by their superiors. The surveyed are not satisfied with the procedures used in the departments to improve work performance. They believe that supervisors still maintain barriers which prevent initiative and innovation. The leadership encourages subordinates to compete among themselves in order to be more productive, but this results in hostility, suspicion and suboptimization.

- **Point 13: Institute a vigorous program of education and retraining**

The average mean value of 3.06 indicates the tendency of leadership to encourage and provide education and retraining necessary for the subordinates to meet the future needs of the ship.

Table XXVI
Statistical Values for Deming
Point 13, Greek Officers

QUE	MEAN	STD DEV
38	2.916	1.316
55	3.458	1.020
77	2.833	1.493
DEM 13	3.069	1.303

On the other hand, the Navy does not support the investment of its resources to train and educate its personnel when the training is not directly related to the current job.

2. Comparison between USN/Greek Officers surveys

Figure 6 shows the mean values for each of Deming's points for the U.S. and the Hellenic Navy.

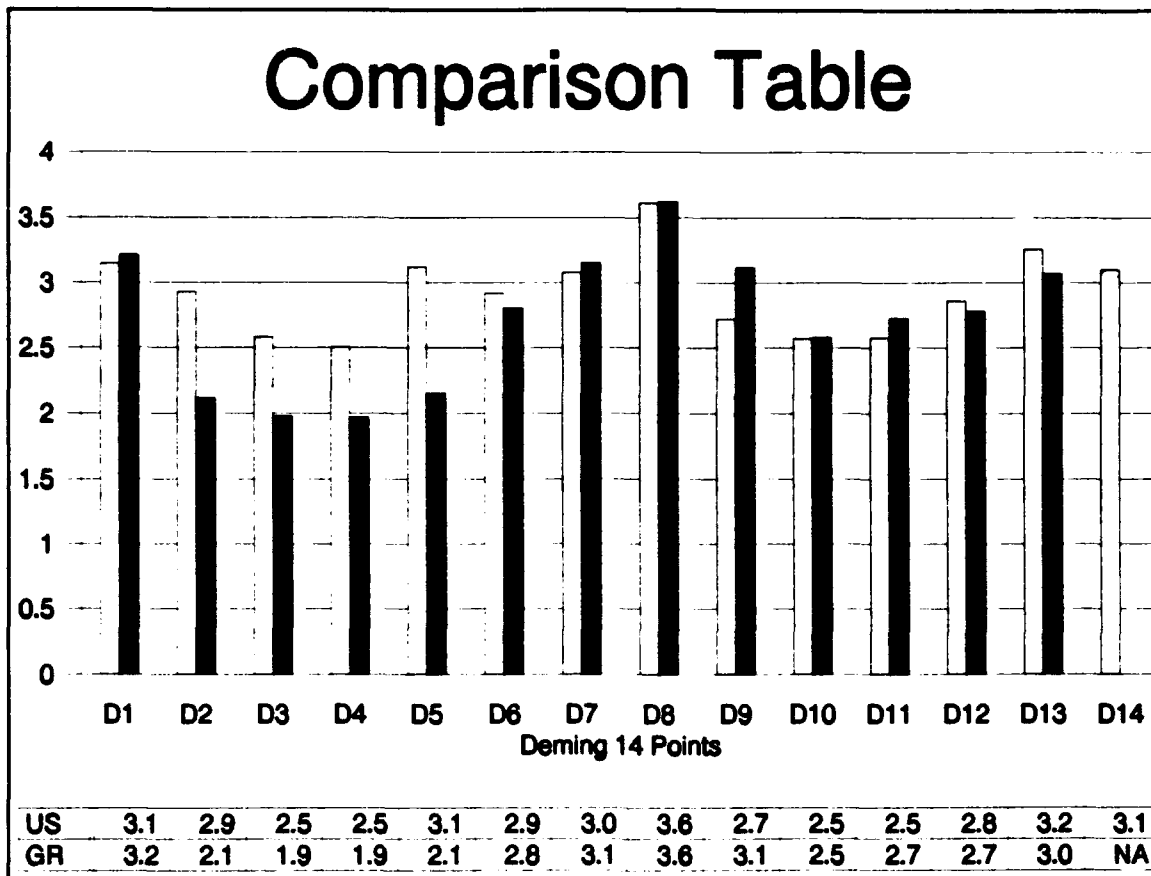


Figure 6: Comparison of USN / Greek Officer surveys

Points 1,7,8,13, and 14 have positive values above 3.00 and indicate; for the U.S. Navy constancy of purpose, leadership, fear reduction (most personnel feel more free to make recommendations), education and retraining, and transformation were adopted and functioning adequately. For the Greek Navy these points indicate that there is constancy of purpose (although for the short term planning), leadership is capable and functions close to Deming's philosophy, those surveyed feel there is no problem with the fear , education and retraining are desirable and to a degree are being

achieved, the transformation value is not valid since there is no transformation taking place in the Hellenic Navy.

In Point five(5) the USN responses indicate that there is a positive improvement in the system of production and service due to TQL. In the Hellenic Navy the need for improvement is recognized to eliminate waste in materials and supplies.

In Point nine (9) the USN respondents, because they include many petty officers and non-rated personnel, there is a belief that there are barriers to communication. The Greek Navy Officers responses show that there are no barriers, at least in the officer level.

In the rest of the Points, where both show a mean value less than 3.00; in the USN there is added effort to implement these Points due to resistance or misunderstanding of TQL, and in the Hellenic Navy there is a definite deficiency and there will be difficulties in implementing these Points.

D. APPLICABILITY TO THE HELLENIC NAVY

This section examines the applicability of TQL for the Hellenic Navy through interpretation of the findings of chapter IV and the responses of Greek Officers.

The findings from the U.S. Navy and the survey of Greek Officers have revealed those areas where TQL probably can be applied and where problems may be expected. Applying a new

philosophy, like TQL, to a military organization such as the U.S. or Hellenic Navy is always a very difficult task, one that requires careful planning and high probability of success. Therefore the findings of this thesis are essential in determining if TQL can be successfully applied in the Hellenic Navy. The relatively short period of TQL application in the U.S. Navy Operating Forces does not permit a full assessment of its feasibility in other organizations, but it is a very valuable indicator and one that shows the difficulties and lessons-learned from such an undertaking. Using Deming's fourteen points, this section will assess the applicability of each for the Hellenic Navy.

1. Constancy of purpose and long-term planning

The survey among the Greek Officers at NPS revealed that there is constancy of purpose, at least in the short-term. There are immediate problems which may hamper the Greek leadership from focusing in the long-term, but if the leadership is convinced that TQL will help in solving or improving the Greek Navy then it can accept TQL. Since the Greek Navy has recently been fitted with new ships and high technology equipment, it is very interested in finding a feasible approach to maintaining and optimizing their capabilities.

2. Adopt the new philosophy

The highly educated Hellenic Navy personnel at all ranks, and the innovative culture with openness to new and ingenious ideas that characterize the Greek people make the acceptance of a new philosophy, like TQL, a relatively viable possibility. It is highly certain that the Hellenic Navy, if it decides to adopt TQL, will attempt to adjust the TQL philosophy to meet the unique characteristics and needs of its organization. Like the U.S. Navy, it is expected that there will be some initial resistance to this new concept, especially by those with long service in the Hellenic Navy. It is highly likely, that once the top leadership makes the decision and commitment to introduce TQL to the Hellenic Navy the entire chain of command, down to the lowest subordinate, will work to make the new system successful.

Over three decades tradition of training middle level officers in U.S. institutions, like the Naval Postgraduate School and the Massachusetts Institute of Technology (MIT), give the Hellenic Navy an excellent chance to accept and be willing to try an innovative new philosophy.

3. Cease dependence on mass inspection

Because Greece is highly dependent on foreign sources for most of its Naval equipment, it cannot avoid the requirement of inspections and verification that what it purchases meets the required specifications. At the same time,

there is a large need to reduce the problematic and wasteful institutionalized requirement by higher authorities for frequent inspections. These inspections receive so much emphasis and require such a high focus and resources for short-term fixes, instead on focusing on improving the long-term process that TQL emphasizes, that there is a great need for TQL in the Hellenic Navy.

4. End the practice of awarding business on price tag alone

There is unanimous agreement by the Greek Officers that the Hellenic Navy, due to constraints in budget, is frequently forced to make purchases of key systems and equipment with the price tag playing a significant role. As long as this budgetary problem remains, combined with the absence of a viable domestic defense industry, the adoption and adherence to this point of Demming will probably be very difficult for the Hellenic Navy.

5. Improve constantly products and services

There is a recognized need within the Hellenic Navy to constantly improve the system of production and service, and therefore TQL has applicability. There is a need to eliminate waste of materials and supplies, which can be achieved if TQL statistical process control and tools are correctly applied.

6. Institute training

The findings show that training in the Hellenic Navy is presently sufficient, but only for the short-term immediate needs. There are needs to plan for the future, and a change from dependence on-the-job training and more reliance on institutionalized professional training, especially for the lower ranks. All these requirements can be achieved through adoption of TQL.

7. Institute leadership

All findings support that the leadership of the Hellenic Navy is of high quality and capability, but as is the case within the U.S. Navy there is a continuous need for improvement that can be achieved through TQL.

8. Drive out fear

The findings from the Greek Officers survey show that there is no fear among the officers, but there is a problem with the other ranks. The TQL philosophy if adopted will help to alleviate fear among all ranks and will likely improve the efficiency in the Hellenic Navy through promotion of open exchange of ideas and recommendations through teamwork.

9. Break down barriers

The cultural characteristic of the "ego" makes it difficult for the Hellenic Navy to completely tear down barriers, especially among higher ranks which are in constant competition for upward mobility. TQL can greatly improve in

this area and also in the barriers created among departments. However, due to the long tradition and distinct characteristic of the Greek people in their quest for the top positions of leadership, only marginal improvements can be expected from application of TQL.

10. Eliminate slogans

TQL provides methods and resources that the Greek Navy leadership can use as an alternative to slogans, exhortations and targets in order to optimize the productivity of the workforce.

11. Eliminate numerical quotas

The survey of Greek Officers shows that there is a need for the Greek leadership to better utilize numerical quotas to reflect realistic goals and promote support and acceptance from the subordinates. TQL can be applied to eliminate or more likely limit the use of quotas in the Hellenic Navy.

12. Remove barriers to pride of workmanship

Today there are barriers to pride of workmanship in the Hellenic Navy that cause overload of work among the officers and frustration among lower ranks who are trying to realize their full potential. There is a lot of promise for TQL to break this strong but very harmful characteristic found in the Hellenic Navy. It will allow those personnel who work on older, more maintenance intensive equipment to have the

same pride to workmanship as those who work on more modern less maintenance intensive equipment. If TQL is applied, it will be a long-term goal to achieve.

13. Institution of education and retraining

The Hellenic Navy leadership is focused on providing education that is specific to the mission. TQL will help them to realize the benefits from promoting individual education outside the needs of the mission. The more education available to personnel, the better their productivity and dedication.

14. Transformation to TQL

The transformation will require a great effort and a strong commitment from the leadership. Through successful pilot projects as those that have been used and reported by the U.S. Navy ships., the leadership and subordinates will be convinced and more patient of the utility and success of the new philosophy.

The draftees, who spend only two years in the Navy, and the retirees who have used TQL will be able to pass on and transform the Greek society in the future with the benefits of the TQL.

VI. CONCLUSIONS -RECOMMENDATIONS

The conclusions below are constrained by the following factors:

- The findings are based on surveys conducted on five U.S. Navy Commands and twenty-four Greek Officers attending the Naval Postgraduate School. The sample size used was rather small and not scientifically arrived at to give greater reliability to the findings and the suggested conclusions.
- The failure of some commands to provide their responses on time made the target sample much smaller and thus less representative of the U.S. Navy. The lack of in-person interviews with the top management of the U.S. Navy ships prevented the opportunity for more in-depth questions or for clarification of the given responses.
- At the time these surveys were conducted, the participating commands had only two years experience with the implementation of TQL. Therefore, the findings do not reflect a long-term experience nor do they reflect the final success or failure of TQL. Future studies are needed to fully assess the implementation, functioning and success rate of TQL.

A. CONCLUSIONS

The main questions this study attempted to answer are; (1) is TQL applicable and functioning in the U.S. Navy? and (2) if TQL is applicable in the U.S. Navy, can it also be adopted in the Hellenic Navy? The conclusions arrived from the findings of this study are as follows:

1. U.S. Navy Commands

TQL is applicable and functioning in the U.S. Navy. Despite having experience with TQL for only two years, the commands that participated in this study indicated that TQL has already been a success. Given strong support from the leadership and proper education of the participants, TQL seemed to have produced positive results in most of Deming's fourteen points. It is most noteworthy to find that TQL is being implemented onboard ships without disruption in the operational readiness of these organizations. These findings clearly indicate that TQL is applicable for the U.S. Navy.

2. Hellenic Navy

TQL shows promise for the Hellenic Navy. Although there are important prerequisites that must be met before implementation, like acceptance of Deming's philosophy by the Hellenic Navy's leadership and proper training for all participating personnel, the surveys among the Greek Officers indicate a need for and applicability of TQL in the Hellenic Navy. The resistance to TQL by the civilian and military leadership is expected to be its biggest obstacle. The fact that the Greek Navy is much smaller and more homogeneous than the U.S. Navy, and many Greek Naval Officers are being educated in the U.S. enhances the chances for TQL's success in the Hellenic Navy.

In addition, this study has given many indications that TQL can be further adopted by other organizations within Greece. Based on the fact that in the U.S., TQL was first applied in the private sector and then transferred in the U.S. Navy, the possible application of TQL in the Hellenic Navy could lead to its transfer and adoption by the wider spectrum of the Greek society.

Like its application in the U.S. Navy, TQL will encounter many problems before it is accepted and successfully implemented in the Hellenic Navy. One key problem that must be overcome is the Greek cultural trait of the "ego." This is a problem because TQL depends on team work and removal of barriers to individual pride of workmanship.

Given Greece's perceived national security threats, particularly the expansionist designs of Turkey against Greek territories in the Aegean Sea and Cyprus, TQL can provide a significant force multiplier in the Hellenic Navy to successfully counter such threats.

B. RECOMMENDATIONS

1. U.S. Navy

The Navy leadership must be more committed and more confident of TQL, and utilize its middle managers to complete the transformation. Obstacles encountered during the implementation should not result in the scrapping of TQL. TQL should be looked upon as the accepted Navy philosophy and

endorsed by the Chief of the Naval Operations as an established methodology throughout the Naval Forces. Due to the relatively recent introduction of TQL in the U.S. Navy and its continuing implementation, there should be continuous in-progress evaluations at various levels.

2. Hellenic Navy

This study of the USN's experience with TQL should be widely disseminated throughout the Hellenic Naval leadership. Additionally, in-depth studies conducted on other aspects of the U.S. Navy's Operational Forces experiences with TQL implementation should be studied. A detailed feasibility study should be conducted in the Hellenic Navy to determine whether TQL can be adopted and at what cost.

This researcher highly recommends that the Greek Naval leadership start a TQL pilot program to determine applicability through demonstration units. This will make it easier to determine obstacles, cost, and a full range of applications and benefits. Greek Officers, graduates of NPS and educated in TQL, should be put in charge of the pilot program to educate all the participating personnel.

It is the opinion of the researcher and author of this thesis that the way of introducing the TQL philosophy in Greece will be the key to the successful introduction and acceptance of such a new idea, because Greeks, although curious and adventurous, are very suspicious of anything

foreign - especially American. Also, TQL, if adopted will contribute significantly in the reduction of waste in materiel and supplies, will allow for teamwork with enhanced communication among skilled members and leadership to improve the various processes, and will help in overall long-term planning.

C. SUGGESTIONS FOR FURTHER RESEARCH

As this research is one of fairly narrow scope, further research that is more broadly focused should be conducted. Given more time and the benefit of this thesis, future studies should try to replicate and expand the research to other phases.

In the area of ship inspections, a future study can shed more light on how to reduce them. If reduction is not feasible, future studies could give indicators on how to use inspections as an internal evaluation tool for the ships. Thus, inspections can serve in the continuous improvement efforts instead of just the compliance to rules and regulations.

Every effort should be made, when conducting surveys, to make them in-person, using more representative questions and wider scope climate questionnaires.

Since TQL is not yet fully implemented, similar studies should be conducted at regular intervals to determine the progress of its implementation and impact. Another element

progress of its implementation and impact. Another element that needs further research is the educational level required at different ranks by all those involved in the implementation of TQL. As the TQL implementation progresses, there may be different educational requirements that have not yet been anticipated.

APPENDIX A. SURVEY FOR USN OPERATING FORCES

COVER LETTER TO THE U.S. NAVY OPERATING FORCES INCLUDING INTERVIEW QUESTIONS AND CLIMATE SURVEY QUESTIONNAIRE

Dear Sir!

August 25, 1993

My name is Alexandros Theodossiou, LCDR of the Hellenic Navy and student in Naval Postgraduate School in Monterey. I attend the curriculum 817 (Defense Systems Management) in Administrative sciences and my graduation date is December 15, 1993.

I am currently writing a thesis, entitled " Assessment of the Implementation of Total Quality Leadership (TQL) on U.S. Navy ships and Perspectives for Future Implementation by the Hellenic Navy."

I believe that TQL is an innovative philosophy for managing organizations, and I expect through my thesis to examine the applicability of TQL in the Hellenic Navy. To accomplish this, I need to examine how TQL is implemented on U.S. Navy ships.

My original plan was to interview CO, XO, TQL Coordinator, a one Department Head, the command master chief and to administer a survey to a random sample of 20 crew members.

Due to your current operational obligations, I missed the opportunity to visit your ship to conduct this assessment. Thus I am requesting your assistance in completing the enclosed survey and interview questions. You are welcome to keep a copy of both documents and if you or your command are interested in a copy of my thesis I will be most happy to provide it.

Following there are instructions how to administer the survey and interview questions.

Instructions:

a. Interview Questions: Five(5) sets of interview questions are enclosed. I would like the CO, XO, One Department Head, TQL coordinator and the senior Petty officer (total 5 persons) to complete these questions. Answers should be written in the blank space below each question. If the answers exceed the available spaces, please have interviewees use either the back side or the attached white pages.

b. Survey: The survey should be administered to a random sample of twenty people on board the ship. Survey instructions are self-explanatory.

c. Returning Completed Forms: Please return the completed forms in one package by 24 September. This will give me enough time to analyze the results and complete my thesis before my

graduation in December 15, 1993. Please mail the package of responses to the following address:

RETURN ADDRESS

**SUPERINTENDENT (CODE 36)
NAVAL POSTGRADUATE SCHOOL
MONTEREY CA. 93943-5000
ATTN:LCDR Alexandros Theodossiou**

I have enclosed a preprinted envelope for your convenience.

Thank you for your cooperation and assistance. The information you provide will be in valuable, not only to my thesis, but for the future of the Hellenic Navy.

This survey is designed to obtain your thoughts about your job and the ship as an organization. It is based on Dr. W.E. Deming's 14 points. Your honest opinions are important. Your responses will be used to see if TQL can be applied to the Hellenic Navy.

Please read each question carefully before responding.

On the first two pages are 4 questions that concern your status in the Navy and your education and training in TQL. The next 7 pages include 77 questions on implementation of TQL through the departments in your ship.

Marking Directions:

Simply blacken the box(one per question) that represents your answer.

EXAMPLE QUESTION

1. I want to learn more about how to improve my work process.
- | | SA | A | U | D | SD | NA |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

KEY: SA Strongly Agree
A Agree
U Undecided
D Disagree
SD Strongly Disagree
NA Not Applicable/Don't Understand

	SA	A	U	D	SD	NA
<u>correct mark</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<u>incorrect mark</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-----------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

Use the "Not Applicable/Don't Understand" category when you do not know the answer to a question or when you think the question is not applicable to you.

Some Definitions You Will Need To Know Before You Start The Survey

Leadership Any/all levels of supervision in the ship. From the first line supervisor to Ship Commander.

Customer The person or organization to whom you provide a product or service.

Statistical Process Control The use of statistical elements and charts which help in analyzing the process and improving quality.

TQL Total Quality Leadership. The application of quantitative methods and the knowledge of people to assess and improve: materials and services supplied to the organization; all

significant processes in the organization;
and meeting the needs of the end user, now
and in the future.

Work team The people who work with you most frequently
 (on a day-to-day basis).

Senior The highest-ranking official of the ship and
Leaders those reporting directly to that official.

YOUR RESPONSES WILL BE TREATED AS CONFIDENTIAL

The following questions ask about your current rank, the
time you served on the ship, your experience in specific TQL
roles and your exposure to Department of the Navy TQL training
courses.

Please make sure you correctly mark the small square. If
you change any answer, please erase completely.

Correct mark ☐ **incorrect mark** ☐ ☐ ☐ ☐ ☐

1. What is your rank?

- ☐ Officer
- ☐ Chief Petty Officer
- ☐ Petty Officer
- ☐ Non Rated

2. How long have you been on board this Command?

- ☐ Less than one year
- ☐ 1-3 years
- ☐ more than 3 years

3. Have you served as a member of:

(more than one answer may be blackened in)

- ☐ a Process Action Team?
- ☐ a Quality Management Board?
- ☐ The Executive Steering Committee?
- ☐ a TQL team advisor/facilitator?
- ☐ None of the above

4. What TQL education have you had?

(more than one answer may be blackened in)

- ☐ TQL Orientation Briefing by senior leaders, mid-managers, or supervisors
- ☐ Introduction to TQL (1-DAY)
- ☐ Fundamentals of TQL (4-DAY)
- ☐ Implementing TQL
- ☐ Systems Approach to Process Improvement (SAPI)
- ☐ Team Skills and Concepts for TQL
- ☐ Methods for Managing Quality
- ☐ Other
[Please explain]: _____

INTERVIEW QUESTIONS FOR THE SENIOR LEADERS OF OPERATING FORCES

1. How did you determine who your customers are? How did you initially determine your customers needs or requirements? How do you ensure you continue to update your customers needs?

Questions 2-5 relate to specific improvements your command has made using TQL

2. Please list 3 areas your ship has improved using TQL.

3. How did you organize the team(s) to improve each process/area and who was on it?

4. What was the level of performance before you started the improvement work?

5. How do you plan to determine how well the changes are working?

6. What is your assessment on the acceptance of TQL by the crew? Are there any differences among various groups of personnel?

7. Have you targeted the PMS for improvement? If so how?

8. Has TQL affected the proper functioning of the chain of Command on the ship (command)? If so how?

9. How did the TQL affect the discipline and the morale onboard?

10. Has TQL improved the operational readiness of your ship (command)? If so how?

11. How has your involvement in TQL affected your fitrep/evaluation?

12. What major problems did you face, in which areas within the ship (command) did the problems occur upon the implementation of TQL?

13. How does the transfer of new crew members affect the application of TQL?

14. What do you think U.S. Navy ship experience tell us about the applicability of TQL to another Navy (Hellenic Navy)?

NAVAL POSTGRADUATE SCHOOL KEY:
DEMING SURVEY

SA Strongly Agree
A Agree
U Undecided
D Disagree
SD Strongly Disagree
NA Not Applicable/Don't Understand

	SA	A	U	D	SD	NA
1. Leadership believes and acts as though sailors are the most important asset of the ship.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. The great emphasis on statistical process control has been a waste of time and money.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I sense that Leadership is starting to pay more attention to the long range results of their actions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Many sailors talk as though they accept the new quality philosophy while actually resisting it.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I have a clear idea of who my immediate customers are and what they need.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I don't have enough opportunity to use my abilities in my present job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Training onboard this ship is done on a "hit or miss" basis.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. There is good cooperation and communication between departments.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I frequently worry about the future of the ship.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Leadership seems to believe that sailors need numerical goals to stay motivated.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Leadership has helped me understand how quality and productivity are related.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Our Leaders seem to be unable to plan well for tomorrow because of problems they need to deal with today.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**NAVAL POSTGRADUATE SCHOOL
DEMING SURVEY**

KEY:
SA Strongly Agree
A Agree
U Undecided
D Disagree
SD Strongly Disagree
NA Not applicable/Don't understand

	SA	A	U	D	SD	NA
13. I feel that Leadership is supportive and understanding when we have new responsibilities ant tasks to learn.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. The ship often fails to live up to its commitment to customer satisfaction.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. I am actively involved in trying to improve my work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. We depend heavily on inspection to make sure that quality products and services are being delivered to our customers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. My training fails to keep up with technological and organizational changes.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. With all of the changes going on, I am no longer certain what my responsibilities are.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. My supervisor helps me to actively apply my training in my work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. I often feel frustrated or angry because I have no control over my workload.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. People who get promoted in my department truly deserve it.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Leadership sees to it that, whenever possible, all areas of the ship share in sacrifices that need to be made.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. There is a great waste of materials and supplies in my department.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**NAVAL POSTGRADUATE SCHOOL
DEMING SURVEY**

KEY:
SA Strongly Agree
A Agree
U Undecided
D Disagree
SD Strongly Disagree
NA Not Applicable/Don't Understand

- | | SA | A | U | D | SD | NA |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 24. My department works closely with our suppliers in order to improve the quality of the materials they send us. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 25. Statistical process control is the only really essential thing we need to continuously improve our quality. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 26. Information is shared and cooperation is emphasized between departments. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 27. I don't really understand what Leadership is trying to do in the area of quality improvement. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 28. To achieve greater productivity, Leadership emphasizes quantity more than quality. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 29. I feel free to recommend improvements to my job to my supervisor. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 30. I believe that the focus on quality is just one more program that will fade away like all the others. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 31. My supervisor tries to remove barriers that prevent me from doing my work well. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 32. The procedures we use in this department help me to do a good job. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 33. The work standards or quotas that I have been given are arbitrary and unreasonable. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 34. It often seems like this operation is run on the "idea of the month". | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

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D Disagree
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	SA	A	U	D	SD	NA
35. I have a clear idea of what the mission of this ship is.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36. Leadership has been sensitive in working with sailors to get their participation in the quality improvement effort.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. Before sailors are given new jobs and responsibilities, they receive training that is appropriate and complete.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. The ship supports my desire to improve myself even if it doesn't relate directly to my current job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. Unless we inspect incoming materials, we cannot trust our suppliers to provide quality materials.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40. I am often encouraged to compete with others to be more productive.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. Leadership rewards team efforts more than individual ones.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. Leadership is actively involved in helping me to stabilize and improve my work process.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
43. I have a clear idea how my department's goals fit in with the organization's goals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
44. Leadership often asks us to "take pride in our work".	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
45. There is too much rework necessary for us to eliminate inspections.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**NAVAL POSTGRADUATE SCHOOL
DEMING SURVEY**

KEY:
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A Agree
U Undecided
D Disagree
SD Strongly Disagree
NA Not Applicable/Don't Understand

	SA	A	U	D	SD	NA
46. Little effort is made to get my opinions and thoughts on work matters.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
47. I often wish I had more time to improve my work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
48. Leadership follows through on recommendations for process improvement submitted by improvement teams.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
49. I am having difficulty relating the new quality improvement philosophy to my work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
50. New sailors don't understand what is expected of them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
51. I am so busy that I don't have enough time to spend on defining and improving my work process.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
52. Targets that are set by leadership include tools and methods for reaching them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
53. My supervisor leads by setting a good example to follow.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
54. There is a strong sense of "us" vs. "them" between departments in the ship as a whole.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
55. Leadership encourages and provides education and re-training necessary to meet the future needs of the ship.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
56. Leadership relies less on inspection and rework and more on helping us improve the work process we use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**NAVAL POSTGRADUATE SCHOOL
DEMING SURVEY**

KEY:
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D Disagree
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- | | SA | A | U | D | SD | NA |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 57. I trust Leadership to act on most of the issues brought to its attention through this survey. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 58. If I work hard I can do better than the work standard that is set. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 59. I believe that leadership is strongly committed to carrying out the mission of the ship as stated in the mission statement. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 60. The tools and work environment I have enable me to produce quality work. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 61. I want to learn more about how to improve my work process. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 62. Leadership doesn't appear to have adequate understanding of statistical methods for improving our work processes. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 63. Leadership seems afraid to meet sailors face to face. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 64. Our ship really seeks to learn who our customers are and what they expect. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 65. Leadership may stress quality of supplies, but they still make purchasing decisions based on the immediate cost. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 66. If everyone just tries harder, we can solve our quality problems. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 67. We have been using statistical process control for a while, but it doesn't seem to be working. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**NAVAL POSTGRADUATE SCHOOL
DEMING SURVEY**

KEY:

SA Strongly Agree

A Agree

U Undecided

D Disagree

SD Strongly Disagree

NA Not Applicable/Don't Understand

	SA	A	U	D	SD	NA
68. I am confident that my work process produces excellent quality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
69. Current work standards or quotas make it difficult for me to produce good work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
70. The training department is actively involved in teaching sailors the tools necessary for quality improvement.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
71. Leadership seems afraid that they will lose control if we are given more responsibility for our work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
72. Adequate information is available about the overall quality improvement activities of the ship.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
73. My supervisor seems to understand little about my job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
74. Important values are often compromised in decisions made here.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
75. The risks of having a single supplier for an item out weigh the benefits.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
76. Our work team includes members from other departments when they are needed to solve a problem.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
77. The ship as organization is willing to invest in developing my potential to be the best sailor I can be.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX B. QUESTIONS FOR THE CINCPACFLT TQL TEAM

1. How do you contribute in the implementation of TQL onboard ships?
2. How do you plan to determine how well the TQL philosophy is implemented?
3. How did you organize the teams on the ships?
4. What major problems did you face, in which areas within the ship did the problems occur upon the implementation of TQL?
5. What mistakes could be avoided when starting another implementation of TQL?
6. What general steps should be followed from the beginning to implement the TQL philosophy on a ship?
7. How has TQL effected the proper functioning of the chain of Command on the ship? Does everybody understand who is the boss and who is the worker?
8. How does the Leadership ensure that sailors do not have fear to speak out?
9. What do you think experiences on U.S. Navy ships tell us about applicability of TQL to another Navy (Hellenic Navy)?

APPENDIX C. STATISTICAL VALUES FOR DEMING'S 14 POINTS**MEAN VALUES OF DEMING'S 14 POINTS FOR U.S. NAVY**

DEMING POINT	RESPONSES	NUMBER OF QUESTIONS	MEAN	STD DEV	MIN	MAX
1	39	10	3.202	1.275	0.0	5.0
2	39	9	2.989	1.216	0.0	5.0
3	39	4	2.535	1.227	0.0	5.0
4	39	3	2.436	1.335	0.0	5.0
5	39	7	3.170	1.295	0.0	5.0
6	39	6	2.996	1.279	0.0	5.0
7	39	10	3.157	1.229	0.0	5.0
8	39	1	3.714	1.348	0.0	5.0
9	39	5	2.776	1.253	0.0	5.0
10	39	3	2.571	1.222	1.0	5.0
11	39	4	2.619	1.177	0.0	5.0
12	39	10	2.914	1.211	0.0	5.0
13	39	3	3.357	1.222	0.0	5.0
14	39	2	3.142	1.173	0.0	5.0

MEAN AND STD DEV FOR GREEK OFFICERS RESPONSES

DEMING	RESPONSES	NUMBER OF QUESTIONS	MEAN	STD DEV	MIN	MAX
1	24	10	3.212	1.589	0.0	5.0
2	24	9	2.120	1.771	0.0	5.0
3	24	4	1.979	1.289	0.0	5.0
4	24	3	1.972	1.491	0.0	5.0
5	24	7	2.154	1.804	0.0	5.0
6	24	6	2.805	1.440	0.0	5.0
7	24	10	3.154	1.324	0.0	5.0
8	24	1	3.608	1.157	1.0	5.0
9	24	5	3.116	1.175	0.0	5.0
10	24	3	2.583	1.230	0.0	5.0
11	24	4	2.729	1.349	0.0	5.0
12	24	10	2.783	1.654	0.0	5.0
13	24	3	3.069	1.303	0.0	5.0
14	24	2	3.250	1.328	0.0	5.0

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